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THE NATURAL HISTORY SECRETARY.

"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

Part II.—PHYSICAL SCIENCE.

No. I.—1876.

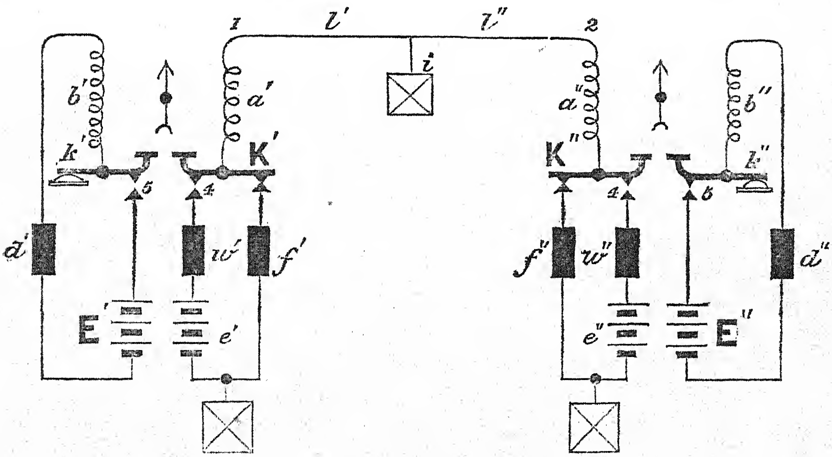
I.—*On the General Theory of Duplex Telegraphy.*—*By* Louis Schwendler.

(Continued from Vol. XLIV, Part II, 1875.)

III. The compensation method.*

This method is the oldest; Fig. 3 gives the general diagram.

FIG. 3.



* Dr. Wilhelm Gintl, Director General of Telegraphs in Austria, is the inventor of this earliest method. In 1853 he made the first practical experiment on a line between Vienna and Prague (240 miles).

Explanation of diagram.

e is the E. M. F. of the line battery.

β its internal resistance.

E is the E. M. F. of the compensation battery.

α its internal resistance.

K is a constant resistance key. Dr. Gintl used an ordinary key, which, it will be obvious, must result in a failure.

k is an ordinary key; both keys, in the same station, are worked simultaneously, *i. e.*, contacts 4 and 5 are closed and broken at one and the same time.

d, f, and w are certain resistances.

a is the *one* coil of the differential instrument which is connected up in the line circuit.

b is the *other* coil of the differential instrument which is connected up in the compensation circuit. By a and b shall be also designated the resistances of these two coils.

The coils a and b with their batteries e and E respectively are arranged in such a manner that they have opposite magnetic effects with respect to the same magnetic pole. The two circuits in each station (the line circuit, and the compensation circuit) are insulated from each other. All the other terms, as L, L', L'', &c., shall have the same physical meaning as before.

The compensation method has two principal defects which the two preceding methods do not possess.

Firstly. The success of working a line duplicé by the compensation method will clearly depend on the possibility of being able to close and open simultaneously two different contacts (4 and 5). The mechanical difficulty of doing so sufficiently accurately was pointed out by Dr. Werner Siemens, and in fact constitutes one of the reasons which led him to propose the differential method.

Secondly. The balance in each station may be disturbed *directly* by a variation of the electrical condition (internal resistance and E. M. F.) of the two batteries (E and e) employed.

In the preceding two methods the variation of the internal resistance of the signalling battery can only be felt *indirectly* by affecting the balance of the distant station, while the variation of E. M. F. has no effect at all. Hence a given variation in the battery or batteries must necessarily produce a greater disturbance of balance in the *compensation method* than in the two preceding ones. We know that even so-called constant galvanic batteries, doing work, alter their electrical conditions perceptibly, especially their internal resistance, and consequently this defect weighs most decidedly against the compensation method. In all other respects the compensation

method has the same defects as the differential method, and in addition some others which will be understood as the investigation proceeds.

General expressions for the two functions "D" *and* "S."

To obtain the functions D, and S, we have to develop the general expressions for the forces p, P and Q, say for Station I.

$$p' = A'\,m' - B'\,n'$$

where A', and B' are the currents which pass through the two coils a' and b' respectively, when Station I is sending and Station II is at rest; m' and n' are the forces exerted by the two coils a' and b' respectively on one and the same magnetic pole, when a unit of current passes through them. At balance in Station I, $p' = o$.

Further $$P' = \mathfrak{A}'\,m'$$

where $\mathfrak{A}'$ is the current which passes through the coil a' when Station II is sending and Station I is at rest (single signals).

Further $$Q' = \mathfrak{y}'\,m' + \mathfrak{g}'\,n'$$

where $\mathfrak{y}'$, and $\mathfrak{g}'$ are the currents which pass through the coils a', and b' respectively when both stations are sending simultaneously (Duplex signals).

The compensation circuit, and the line circuit in each station being electrically independent of each other, we have

$$\mathfrak{g}' = B'$$

invariably without condition.

If we further presuppose that depressing of the key K does not alter the complex resistance of the station, a condition which, for the regularity of signals, we are obliged to assume here as well as in the two preceding methods, it will be clear that

$$\mathfrak{y}' = \mathfrak{y}' + \mathfrak{A}'$$

Substituting these values for $\mathfrak{y}'$ and $\mathfrak{g}'$ in the expression for Q', we get:

$$p' = A'\,m' - B'\,n'$$
$$P' = \mathfrak{A}'\,m'$$
$$Q' = (A' + \mathfrak{A}')\,m' + B'\,n'$$

The signs of the terms may be again contained in the currents, while m' and n' are taken as absolute numbers. We must only remember that $A'\,m'$, and $B'\,n'$ must be invariably of opposite sign. Arbitrarily we will call the current A positive when the negative pole of the line battery is to earth.

Now we have again two different modes of connecting up the line batteries, *viz.*:—

1*st.* The same poles of the line batteries are connected to earth in the two stations:

$$p' = \pm A' m' \mp B' n'$$
$$P' = \mp \mathfrak{A}' m'$$
$$Q' = (\pm A' \mp \mathfrak{A}') m' \mp B' n'$$

2nd. Opposite poles of the two line batteries are connected to earth in the two stations:

$$p' = \pm A' m' \mp B' n'$$
$$P' = \pm \mathfrak{A}' m'$$
$$Q' = (\pm A' \pm \mathfrak{A}') m' \mp B' n'$$

Subtracting in either case P' from Q', we get

$$Q' - P' = S' = p'$$

Or, on account of having fulfilled the key equation $f = w + \beta$, the difference of the forces which produce single and duplex signals is equal in sign and magnitude to the force by which balance is disturbed. Further it is, also for the compensation method, quite immaterial whether the same or opposite poles of the two line batteries are connected to earth. As pointed out, it is preferable to connect the same poles, *i. e.*, the negative poles of the line batteries to earth.

Assuming this case we have:

$$p' = A' m' - B' n'$$
$$P' = - \mathfrak{A}' m'$$
$$Q' = (A' - \mathfrak{A}') m' - B' n'$$

Substituting now for A', B', and $\mathfrak{A}'$ their values, and remembering that

$$\left.\begin{aligned} m' &= q' \sqrt{a'} \\ n' &= r' \sqrt{b'} \end{aligned}\right\} \text{approximately.}$$

we get the following general expressions for the two functions D and S:

$$\left.\begin{aligned} S' &= e' q' \frac{\Delta'}{R' K'} \\ D' &= \frac{e'}{e''} \cdot \frac{K''}{R' K'} \cdot \frac{\Delta'}{\mu'' \sqrt{a'}} \end{aligned}\right\} \text{for Station I.}$$

and

$$\left.\begin{aligned} S'' &= e'' q'' \frac{\Delta''}{R'' K''} \\ D'' &= \frac{e''}{e'} \cdot \frac{K'}{R'' K''} \cdot \frac{\Delta''}{\mu'' \sqrt{a''}} \end{aligned}\right\} \text{for Station II.}$$

where $\Delta = R \sqrt{a} - K \lambda v \sqrt{b}$

$R = a + b + d$

$$K = f + a + c$$

$$\lambda = \frac{E}{e}$$

$$v = \frac{r}{q}$$

Rigid fulfilment of the two functions S = o *and* D = o.

For finite quantities these two functions can only become zero if $\Delta = o$, *i. e.*,

$$R\sqrt{a} - K\lambda v\sqrt{b} = o.$$

which is the balance equation for the *compensation method.*

To fulfil this equation permanently, no matter what the special cause of disturbance may be, we can again adopt two essentially different modes of re-adjustment, *viz.* :—

Either leave the two coils a and b or their armatures stationary, and adjust balance by altering the resistance in one or both of the two circuits, or leave the resistances constant and alter the relative position of the two coils or their armatures with respect to a given magnetic pole. These two methods of re-adjusting balance shall be considered separately.

a. Re-adjustment of balance by altering resistances.

In order to have *immediate balance* it will be clear that the alteration of resistance must be restricted to the compensation circuit, which is electrically independent of the line circuit. The total resistance in the compensation circuit consists of three different resistances, namely b, α, and d. Neither b nor α, considering their nature, can conveniently be made adjustable in practice; hence the alteration of resistance in the compensation circuit is restricted to d, which must therefore consist of increments of the proper size. The adjustment of d should be quick and convenient.

In addition to this adjustment, $\lambda = \frac{E}{e}$ may be made adjustable by varying E in increments of *one* cell. Such an adjustment is however not fine enough for ordinary use. The E. M. F. of one cell is too large a quantity in comparison with the total E. M. F. used in the compensation circuit. If the variation of the line current becomes very great, it might perhaps be found convenient to alter E, but as an ordinary mode of adjustment it must be dispensed with.*

* During the period of low insulation of the line it might be advisable and practicable to make E larger than during the period of high insulation of the line (wet and dry season).

It is scarcely needed to point out that to adjust balance by altering the line current, either by varying the resistance or the E. M. F.* or both of the line circuit, must be rejected once for all, because such an adjustment of balance in the one station could never take place without disturbing the balance of the other station; or in other words the required *immediate balance* could not be fulfilled.

b. Re-adjustment of balance by moving the coils or armatures.

If we suppose both the coils or their armatures simultaneously movable in the same direction, then clearly this mode of adjustment contains not only the required immediate balance, but in addition represents also a very rapid and entirely continuous action. For this reason it is apparently preferable to the first method, where the adjustment can only be carried on in *one* branch by varying d in increments.† Which of the two methods, however, is to be chosen finally, depends on other considerations which will

* Alteration of E. M. F. of a galvanic battery cannot be achieved without altering its internal resistance. Hence varying e, would also involve a variation of β, and in order to keep $f = w + \beta$, it would become necessary to alter w simultaneously with e, *i. e.*, w would have to be increased when e decreases and *vice versâ*. This method being rough, would therefore be also inconvenient.

† It has been suggested to adjust balance by a continuous variation of resistance, as for instance by moving a contact point along a thin platinum wire in the same manner as Dr. Wr. Siemens has done in his bridge employed for comparing accurately comparatively small resistances. It is, however, scarcely necessary to point out that such a method, if applied for Duplex Working, must result in a failure, at all events so long as electro-magnetic instruments are used for producing the signals. For in such a case, the resistance of any branch, no matter what special Duplex method may be employed, must bear a certain ratio to the given resistance of the line, in order to get the signals with sufficient force. This ratio, as my investigations have shewn, is by no means a small one, and hence the resistances of all branches, even for a short line, cannot be made small. Therefore the platinum wire, constituting part of one or two branches of the Duplex method employed, must also offer a considerable resistance, *i. e.*, must be of great length. Hence to alter such a large resistance continuously and perceptibly, as is indicated by the balance disturbance, must evidently involve a considerable movement of the contact point, which, even choosing the thinnest possible wire, and the shortest Telegraph line, becomes already for the daily variation so large as to make its application impossible. Unless another material of much higher specific resistance than Platinum wire can be found which, at the same time, allows of the sliding contact being made securely, the adjustment of balance by a continuous variation of resistances must be dispensed with. Such a material does not appear to exist. I thought of acting on Phillips's suggestion to use pencil-marks for the adjustable resistance, and although I found that pencil-resistances can be adjusted very accurately, and can be enclosed in a very small space, and that they keep sufficiently constant, it is difficult, if not impossible, to alter them by a sliding contact. The "*Uebergangs-widerstand*" is too variable and too great. Besides, if the contact is made with sufficient pressure, its sliding along alters the thickness of the pencil mark, and hence the resistances become inconstant and uncertain.

become clear further on. We know now that both these modes of adjustment are convenient and practicable, and contain *immediate* balance without special conditions. In fact in this respect the compensation method is preferable to the differential method where immediate balance by varying resistances could only be obtained when varying the four branches simultaneously, according to a fixed relation

Rapid approximation of the two functions S *and D towards zero.*

On account of $f = w + \beta$ we have

$$S = p = e\,q\,\frac{\Delta}{R\,K}$$

where

$$\Delta = R\sqrt{a} - K\lambda v\sqrt{b}$$

Now suppose $\Delta = o$, then this equation may be disturbed by K, R, λ, v, a, or b varying ; a and b are wire resistances which may be taken as constant, for their variation with temperature is exceedingly small, and in case of accident, *i. e.*, a coil breaking or becoming shunted, nothing short of actual repair could help. Further v, supposing the differential instrument to be properly designed and mechanically well executed, may be taken as a perfectly constant quantity which certainly, as long as the coils or their armatures are not moved on purpose, does not alter of its own accord.

The quantities left, which by variation may affect the balance equation, are K, R, and λ.

Of these three quantities the variation of K may become largest, for K does not only contain the line resistance, which is highly variable, but K includes also the internal resistance of both the line batteries, which, even for the best known form of galvanic battery, is by no means a constant quantity. The variation of the internal resistance of the line battery in each station produces of course the greatest disturbance of balance in *that* station.

The next quantity most liable to change of its own accord is clearly R, since it contains the internal resistance of the compensation battery.

λ, the ratio of the two E. M. F's. in one and the same station, though being also liable to change, will however vary very little. The E. M. F. of a well prepared galvanic battery, especially when the battery is worked by weak currents, is far more constant than is generally believed.*

* It appears that changes which have been observed to take place in the E. M. F. of a Minotto or Leclanche's battery are generally apparent only, not real. Such changes are generally quite within the limits of observation errors, and if they are large they are then generally due to the incorrectness of the method employed for measuring the E. M. F., or to cells actually having become exhausted. It appears that this mysterious force in each cell either exists in its full vigour, or not at all, there seems to be no continuous change in either direction.

With respect to the variation of the three quantities K, R, and λ, the function S may therefore be expressed in three different forms.

$$S_1 = e\,q\,\frac{\lambda\,v\,\sqrt{b}}{R\,K}\,\delta K \text{ when } K \text{ varies only.}$$

$$S_2 = e\,q\,\frac{\sqrt{a}}{R\,K}\,\delta R \quad \text{when } R, \text{ i. e., } a \text{ varies only.}$$

$$S_3 = e\,q\,\frac{v\,\sqrt{b}}{R}\,\delta\lambda \quad \text{when } \lambda, \text{ i. e., } E \text{ or } e \text{ or both are varying only.}$$

These three different disturbances of balance may act singly or conjointly, and it is clear that they are independent of each other, at all events as far as this investigation is concerned. Consequently the safest plan will be to make each influence as small as the circumstances will allow it.

The disturbance S_1 for any constant $eq\,\lambda\,v\,\sqrt{b}$, and any given δK will obviously become smallest the larger $R\,K$ is selected. Supposing $R + K$ constant, whatever that value finally may be, $R\,K$ has a maximum for $R = K$, and the very same condition will obviously make the disturbance S_2 smallest.

S_3 offers no best condition, this expression only shews that it has an absolute maximum with respect to b, namely as

$$R = a + d + b, \text{ for } b = a + d.$$

Thus we are informed that whatever relation between b and $a + d$ may be finally chosen, $b = a + d$ should *not* be selected, as otherwise any given variation of λ would have the greatest possible disturbing effect on the balance. But $b = a + d$ being the condition for the maximum magnetic effect in the compensation circuit, it is hereby established that for the sake of regularity of signals, which under all circumstances is to be considered of paramount importance in Duplex Telegraphy, the magnetic effect in the compensation branch *must not* be achieved in the most economical manner, but quite the reverse. This, as the compensation circuit has actually to produce wholly or partly the *duplex signals*, is a testimonium paupertatis for the compensation method, and proves it in this respect inferior to both the *double balance* and *the differential method.*

$$R = K$$

is the regularity condition for the compensation method, *i. e.*

*In order to make the disturbance of balance by a variation of the resistance in both the circuits absolutely as small as possible, the total resistance of the compensation circuit should be equal to the total resistance of the line circuit.**

* This result is against the adopted view, for Dr. Gintel as well as others after him have always treated the compensation circuit as a kind of *local circuit, i. e.,* giving to it

If we now substitute in S_1 for K the value R, and in S_2 for R the value K we get

$$S_1 = e\,q\,\frac{\lambda\,v\,\sqrt{b}}{R^2}\,\delta\,K$$

$$S_2 = e\,q\,\frac{\sqrt{a}}{K^2}\,\delta\,R$$

while

$$S_3 = e\,q\,\frac{v\sqrt{b}}{R}\,\delta\,\lambda$$

remains the same.

S_1 has an absolute maximum for $b = \frac{a + d}{3}$; S_2 for $a = \frac{f + c}{3}$ and S_3 for $b = a + d$ as stated before.

Hence we know what relations between the different variable, should *not* exist.

This is all we can get from the function S. For further relations we must look to the function D.

For Station I we have*

$$D' = \frac{e'}{e''}\,\frac{K''}{R'\,K'}.\,\frac{\Delta'}{\mu'\,\sqrt{a'}}$$

which again, with respect to the variations of K', R', and λ' may be written in three different forms:

$$D_1' = \frac{e'}{e''}\,\frac{K''}{R'\,K'}.\,\frac{\lambda'\,v'\sqrt{b'}}{\mu'\,\sqrt{a'}}\,\delta\,K'$$

$$D_2' = \frac{e'}{e''}.\,\frac{K''}{R'\,K'}.\,\frac{1}{\mu'}\,\delta\,R'$$

and

$$D_3' = \frac{e'}{e''}.\,\frac{K''}{R'}.\,\frac{v'\,\sqrt{b'}}{\mu'\,\sqrt{a'}}\,\delta\,\lambda'$$

---

as low a resistance as practice allows. But this is clearly wrong, for if R is made very small as compared with K, the balance becomes unstable. This fact explains, to a certain degree, the failure which has attended the application of the compensation method for Duplex working, because the method was tried under the most unfavorable quantitative arrangements.

* When investigating the minimum absolute magnitude of S, the terms could be taken without an accent, because S contains only terms belonging to the same station. When investigating D this cannot be done as D contains also terms belonging to the other station.

Considering that

$$\frac{K''}{K'} = \frac{i + l'' + \rho''}{i + l' + \rho'}$$

$$\mu' = \frac{i}{i + l' + \rho'}$$

and

$$\frac{K''}{\mu'} = L + \rho' + \rho'' + \frac{(l' + \rho')(l'' + \rho'')}{i}$$

we have

$$D_1' = \frac{e'}{e''} \cdot \frac{i + l'' + \rho''}{i} \quad \frac{\lambda' v' \sqrt{b'}}{R' \sqrt{a'}} \cdot \delta K'$$

$$D_2' = \frac{e'}{e''} \cdot \frac{i + l'' + \rho''}{i} \cdot \frac{1}{R'} \delta R'$$

$$D_3' = \frac{e'}{e''} \left\{ L + \rho' + \rho'' + \frac{(l' + \rho')(l'' + \rho'')}{i} \right\} \frac{v' \sqrt{b'}}{R' \sqrt{a'}} \delta \lambda'$$

put $\quad \frac{e'}{e''} = s$

$$\frac{i + l'' + \rho''}{i} = J$$

$$L + \rho' + \rho'' + \frac{(l' + \rho')(l'' + \rho'')}{i} = T$$

and $\quad \dfrac{1}{R'\sqrt{\dfrac{a'}{b'}}} = \dfrac{1}{\psi'}$

$$\therefore \quad D_1' = sJ\lambda' v' . \frac{1}{\psi'} \delta K'$$

$$D_2' = sJ \frac{1}{R'} \delta R'$$

$$D_3' = sv' \frac{T}{\psi'} \delta\lambda'$$

Now keeping s, J, λ', and v' constant, D_1' becomes smallest for any given $\delta K'$ the larger ψ' is selected; while D_3' becomes smallest for any given $\delta \lambda'$ the smaller $\dfrac{T}{\psi'}$ is selected, and D_2' becomes smallest the larger R' is chosen.

Now $\psi' = R' \sqrt{\dfrac{a'}{b'}}$ has a maximum for $a' = b'$;

for $R' = b' + a' + d' = b' + \gamma$, and putting $\gamma = b' t'$ we have

$\psi' = (1 + t') \sqrt{a' b'}$ which, for $a' + b'$, and t' constant, has

clearly a maximum for $a' = b'$. This proceeding is right, because we take b' as the original variable, and vary a' and γ' simultaneously with b', in order to keep t' and $a' + b'$ constant; while J and s are independent of a', b', and γ'.

In order to be sure that $a' = b'$ makes also D_3' a minimum, we must shew that T keeps constant, *i. e.*, ρ' keeps constant when a' varies. But $\rho' = a' + f'$, thus we have only to consider f' simultaneously variable with a' equal and opposite to the variation of a, which is allowed. Therefore the condition $a' = b'$ makes undoubtedly the disturbances D_1' and D_3' minima. While the disturbance D_2', which contains R' in the denominator only, is not affected by this relation, but depends on the absolute value of b' only, which should be chosen as large as possible.

$a = b$ is therefore the *second* regularity condition, the fulfilment of which makes the relative disturbance of balance by a variation of K and λ as small as possible.

Substituting now $a' = b'$ in the expression of the D disturbances and remembering that

$$R' = K'$$

we get

$$D_1' = s\,\lambda'\,v'\,\frac{J}{K'}\,\delta\,K'$$

$$D_2' = s\,\frac{J}{K'}\,\delta\,R'$$

$$D_3' = s\,v'\,\frac{T}{K'}\,\delta\,\lambda'$$

Thus D_1', and D_2', for constant s, λ', and v', become smallest the smaller $\frac{J}{K'}$ is, while D_3' becomes smallest the smaller $\frac{T}{K'}$ is.

Now remembering that

$$J = \frac{i + l'' + \rho''}{i}$$

$$K' = \frac{(l'' + \rho'')\,(i + l' + \rho') + i\,(l' + \rho')}{i + l'' + \rho''}$$

and

$$T = L + \rho' + \rho'' + \frac{(l' + \rho')\,(l'' + \rho'')}{i}$$

$$\therefore\quad \frac{J}{K'} = \frac{(i + l'' + \rho'')^2}{i\,\{(l'' + \rho'')\,(i + l' + \rho') + i\,(l' + \rho')\}}$$

$$\frac{T}{K'} = \frac{i + l'' + \rho''}{i} = \mu$$

For a tolerably good line $l'' + \rho''$ as well as $l' + \rho'$ can be taken as small in comparison with i; hence approximately

$$\frac{J}{K'} = \frac{1}{l' + l'' + \rho' + \rho''} = \frac{1}{L + \rho' + \rho''} \text{ and}$$

$$\frac{T}{K'} = 1$$

From which it follows that also for the compensation method ρ' and ρ'' should be selected as large as possible.

But $\rho = a + f$ does not give a condition besides that we know we should select a and f absolutely *not* small.

Further we see that the disturbance $D_3{}'$ has v' for its factor, while $D_1{}'$ has $\lambda' v'$ for its factor.

Hence for a given $\lambda' v'$, the best will be to make v' as small as possible.

The regularity of the signals is therefore obtained if we fulfil the following conditions in either station.

$$R = K$$
$$a = b$$
$$\rho \quad \text{as large as possible}$$
$$v \quad \text{as small as possible.}$$

Knowing this we may now consider that balance in either station is rigidly obtained, or that

$$R \sqrt{a} - K \lambda v \sqrt{b} = o$$

but $\qquad R = K$

and $\qquad a = b$

we have $\qquad \lambda v = 1$

The absolute value of a may now be determined by considering that it is advisable to produce the signals in either station in the most economical manner.

Maximum Magnetic Moment.

We have

$$P' = \frac{e''}{a'' + f'' + c''} \mu' q' \sqrt{a'}$$

$$P'' = \frac{e'}{a' + f' + c'} \mu'' q'' \sqrt{a''}$$

But

$$\frac{\mu'}{a'' + f'' + c''} = \frac{\mu''}{a' + f' + c} = \frac{i}{Q}$$

where $\quad Q = i\,(L + \rho' + \rho'') + (l' + \rho')\,(l'' + \rho'')$

$$\therefore \quad P = P' + P'' = i\,\frac{e''\,q' \sqrt{a'} + e'\,q'' \sqrt{a''}}{Q}$$

which has a maximum for a' and a'' taken as independent variables.

If we, for instances, take $i = \infty$, than

$$P = \frac{e\,q\,\sqrt{a}}{L + 2\,(a + f)}$$

$$\therefore \quad a = \frac{L}{2} + f \text{ for a perfect line, and by inference}$$

$$\left.\begin{aligned} a &= \frac{L'}{2} + f' \\ a'' &= \frac{L''}{2} + f'' \end{aligned}\right\} \text{ approximately.}$$

Now we can decide on the method to be adopted for re-adjusting balance. On account of the regularity condition $R = K$, and as both undergo variation, especially K, we are obliged to adjust balance in the compensation branch by varying the resistance d, and leave the coils or their armatures stationary.

Thus the general solution of the 1st problem for the compensation method is:

1. Readjustment of balance is to be effected by a variation of resistance in the compensation circuit and *not* by a movement of the coils or their armatures. By this adjustment R is kept equal to K permanently, no matter in which branch the variation takes place.

2. $$\mathbf{f = w + \beta}$$

$$\mathbf{a = b = \frac{L}{2} + f}$$

$$\mathbf{v\lambda = 1}$$

v as small as possible and λ as large as possible.

β is known from the number and nature of the single cells of which the battery has to consist to produce through the given line (connected up in a circuit like Fig. 3) single signals with sufficient strength.

w is known from the absolute largest variation β may undergo in time; hence f is determined and therefore also a and b.

Determination of λ and v.

We know that $\lambda\, v = 1$, and further that $\lambda = \frac{E}{e}$ should be selected as large as possible or v as small as possible, but otherwise it appears that no fixed values for λ and v can be ascertained. If, however, we consider the nature of the variations of R and K, which may disturb the balance, *viz.*: those variations of R and K which are due to unavoidable decrease of the internal resistance of the two batteries by the working currents, it will be seen that a best value of λ does exist, and that therefore v also becomes fixed.

Suppose that at a certain moment

$R = K$ is rigidly fulfilled, and remembering that

$R = b + d + a$

$K = 2\ (a + f) + L$ (for a perfect line, *i. e.*, $i = \infty$)

and further, that

$a = b$

and $f = w + \beta$

we have $d + \alpha = a + 2\ w + 2\ \beta + L.$

Now, in this equation suppose everything constant except α and β, the internal resistance of the two batteries E and e respectively. Hence if we could achieve that

$\delta\ \alpha = 2\ \delta\beta$ invariably,

the variation of the internal resistance of the two batteries would not disturb the equation $R = K$, and therefore also not affect the balance. With absolute certainty we cannot fulfil this desirable relation between the two variations, but with some probability we may. For it is well known that the internal resistance of a galvanic battery decreases in time by the current passing through the battery. Hence, if we suppose that the two batteries consist of identical cells (equal in nature, size, and internal resistance) we may say that the variation of the internal resistance of a single cell by the unit current in the unit of time is the same for both the batteries. Further, if we make the other not improbable supposition, that the variation at any one time is proportional to the current which passes at that time, we have

$$\delta\ \alpha = \epsilon\ E.\ \frac{E}{R + \delta\ R}\ \phi^{(t)} = \epsilon \frac{E^2}{R}\ \phi^{(t)}$$

and $$2\ \delta\ \beta = \epsilon\ e.\ \frac{e}{K + \delta\ K}\ \phi^{(t)} = \epsilon \frac{e^2}{K}\ \phi^{(t)}$$

where ϵ is the variation of the internal resistance of a single cell in unit of time by unit of current; $\phi^{(t)}$ a certain unknown function of the time which, as the two batteries are working simultaneously, is not required to be known.

Hence from $\delta\ \alpha = 2\ \delta\ \beta$

and $K = R$

it follows that $$\lambda = \frac{\mathrm{E}}{\mathrm{e}} = \sqrt{2}$$

and $$\mathrm{v} = \frac{\mathrm{r}}{\mathrm{q}} = \sqrt{\frac{1}{2}}$$

These values of λ and v bring the compensation method, with respect to regularity of working, as close to the differential method as is possible for us to do. For the disturbance of balance in the sending station by the steady decrease of the internal resistance of the two batteries has now been *probably* eliminated, which defect is excluded from the other two methods,

by their own nature. There are then remaining only those variations of the battery resistance which do not follow the law of steady decrease, but which are more accidental, and make therefore the compensation method still inferior to either the differential or bridge method.

Physical meaning of $v \sqrt{\frac{1}{2}}$

It has been proved that balance in each station is to be established by adjusting resistance and *not* by a movement of the coils or their armatures. Hence it will be practical and convenient to coil the two helices above each other, and have them acting on one and the same iron core.

Further as $v = \frac{r}{q} = \sqrt{\frac{1}{2}}$ it follows that the magnetic action of the a coil must be made greater than that of the b coil. Therefore it will be best to coil the helix b on the top of the helix a.

Further the magnetic action of a cylindrical coil of resistance a (in Siemens units) can be expressed as follows:

$$m = s\sqrt{a}\sqrt{\frac{A\,\lambda}{c\,l}}$$

where A is half the cross section of the coil (cut by a plane through the axis of the coil) expressed in $\square$ m m.

λ the absolute conductivity of the wire material ($H_g = 1$ at $O°$ $C.$)

l the length of an average convolution expressed in metres.

s the magnetic force exerted by an average convolution of the coil when the unit of current passes.

c a coefficient representing the manner of coiling.

Hence for the a coil we have

$$m_a = s'\sqrt{a}\sqrt{\frac{A'\,\lambda'}{c'\,l'}} = q\sqrt{a}$$

for the b coil

$$m_b = s''\sqrt{b}\sqrt{\frac{A''\,\lambda''}{c''\,l''}} = r\sqrt{b}$$

Dividing m_b by m_a, and remembering that by condition $a = b$, and that $\lambda' = \lambda''$, $c' = c''$ by necessity, we have:

$$v = \frac{r}{q} = \frac{s''}{s'}\sqrt{\frac{A''\,l'}{A'\,l''}}$$

As we have supposed that the magnetic action of any one cylindrical coil is proportional to the magnetic action* of an average convolution it is also consistent to put $s' = s''$, and we have at last

$$\frac{A'' \, l''}{A' \, l'} = \frac{1}{2}$$

If now the two bobbins of the coils a and b are taken of equal length, and if the thickness of the a coil be d', the thickness of the b coil d'', and the diameter of the iron core $2\,r$, we have,

$$\frac{A''}{A'} = \frac{d''}{d'}.$$

$$l' = (2\,r + d')\,\pi$$

$$l'' = \{2\,(r + d') + d''\}\,\pi$$

$$\therefore \qquad (4\,r + d')\,d'' = 2\,d'\,(r + d')$$

This equation fixes the relative dimensions of the two bobbins and their cores in order to have $v = \sqrt{\frac{1}{2}}$

Suppose for instance we make $d' = d''$ arbitrarily† we get $2\,r = d$, and from it can be easily calculated that the diameter of the wire of the b coil should be *about* 19 *per cent. larger* than that of the a coil. The absolute diameter of the wire depends of course on the absolute dimensions of the bobbins, and on the resistance of the line for which the instrument is to be used. But this question, although of practical importance, has nothing to do with the Theory of Duplex Telegraphy. This settles the solution of the 1st problem of the compensation method.

* Lenz and Jacobi have experimentally proved that, within certain limits, the magnetic force exerted by a convolution on its centre (iron core) is almost independent of the diameter of the convolution. These limits are generally fulfilled in Telegraph Construction. Hence the magnetic action of a coil can be put proportional to the magnetic action of *one* convolution. Theoretically this can of course not be true, for the magnetic force exerted by a convolution necessarily extends on both sides of the plane in which the convolution is situated. Therefore the wider a convolution is the less of its total force exerted will be made use of for producing magnetism in the iron core, and, consequently, the force exerted by a convolution on its centre must decrease with the diameter of the convolution. It appears, however, that this decrease is exceedingly slow, and in the present investigation it is considered unnecessary to be taken into account.

† I have not been able to find anywhere a definite law which connects the diameter of a coil with the diameter of the core acted upon. In Siemens' relay, an instrument so well considered in all its details of construction, the diameter of the coil is about three times the diameter of the core. In the absence of anything else on the subject I thought myself justified in using this proportion. Hence the substitution of $d' = d''$, which gives $d = 2\,r$, or total diameter of the a coil equal to three times the diameter of the iron core.

Other methods. There have been suggested, from time to time, many other methods of duplex working. On a closer examination it will, however, be found that, as a general rule, they do not differ essentially from the three fundamental methods treated of. I shall therefore dispense with the labour of investigating these derived methods.

In case it should be thought necessary to investigate them, no difficulties ought to be met with, if only the general plan of attacking duplex problems be remembered, *viz.*, to draw the diagram of the method in its most general form; develop the forces p, P, and Q; from these three forces determine the functions S and D; find the relations which must hold between the different variables (resistances and e. m. f. s.) of which the system consists, in order to make S and D simultaneous minima; consider the question of *immediate balance* which determines also the best mode of adjusting balance; consider that the movement of the key must not alter the complex resistance of the station to which the key belongs, *i. e.*, that the working of the key must not affect the balance of the distant station; determine the absolute values of the different variables when balance is rigidly fulfilled by considering the question of economy, *i. e.*, establish the relations for maxima currents and maxima magnetic moments; any variables which should then be left indeterminate must be fixed by secondary considerations, and by certain practical conditions.

Before comparing quantitatively the efficiency of the three fundamental methods treated of, it is requred to solve two questions, *viz.*:—The e. m. f. required for each duplex method; the absolute size of the increments of the adjustable resistance.

[To be continued.]

II.—*On some Lizards from Sind, with Descriptions of new Species of* Ptyodactylus, Stenodactylus, *and* Trapelus.—*By* W. T. Blanford, *F. R. S.*

(Recd. November 8;—Read December 1, 1875.)

(With Plates I and II).

A collection of reptiles which I made in Western Sind in the months of January, February, March, and April, 1875, comprises several species not noticed in the province by previous observers. Five lizards are new to the fauna of India, and three of these have not, so far as I can ascertain, been previously described. Two of the three represent genera of *Geckotidæ* not hitherto detected so far to the eastward: indeed, it is doubtful if either of the two has before been found in Asia.

The only additions to our knowledge of the herpetology of Sind made since the publication of Dr. Günther's great work on Indian Reptiles, are contained in papers by Dr. Günther and Dr. Stoliczka. The former described (P. Z. S., 1869, p. 500) some specimens collected by Dr. Leith, and the latter (P. A. S. B., 1872, p. 124) gave an account of a collection made by Dr. Day.

I am obliged to refer occasionally in these notes to my hitherto unpublished work on the zoology of Persia. This has been more than a twelvemonth in type and I hope it will appear before this paper.

Fam. *GECKOTIDÆ.*

1. Hemidactylus Coctæi.

Not common; obtained also by Day.

2. Hemidactylus maculatus.

This is not common in Sind, I think. I have only one specimen, the exact locality of which I have omitted to note.

3. Hemidactylus Persicus.

Anderson, P. Z. S., 1872, p. 378.—W. Blanf., Zoology of Persia, p. 342.

This species is close to the common and well known *H. maculatus*, but is rather stouter. Head above granular, supraorbital region sunk. Granules on snout larger than on occiput. Upper labials about 11 or 12, lower 9 or 10, but as usual the small hinder ones vary in number. Back with numerous trihedral tubercles, not very regularly arranged, about 14 or 15 being to be counted across the back, none of them equal to the ear-opening in size. Cross bands of small pointed tubercles on the upper part of the tail, none of them as large as those in the middle of the back, and none of them coming to the lower portion of the tail at the side; they are confined to the

upper portion, and do not extend half way round the tail; lower surface of tail with a row of broad subcaudals. About 35 to 40 scales across the abdomen; 8 to 10 pores in males, forming a short row with an anteriorly salient obtuse angle in the middle across the præanal region, and not continued on to the thighs.

Colour uniformly greyish white. The largest specimen obtained measures 5·8 inches, of which the tail is 3·2.

I obtained 4 specimens of this species, which at the time I took for a large pale variety of the common *H. maculatus*, in a house near Rohri, with specimens of *H. Coctæi*. It is probable that *H. Persicus* partially or entirely replaces *H. maculatus* further to the west. I have compared the specimens obtained with the type described by Dr. Anderson.

This species is distinguished from *H. maculatus* by having the tubercles on the tail smaller than on the back instead of larger, by their not extending so low down on the sides of the tail, and by there being no femoral pores, but only a short row of pores in the præanal region. In *H. maculatus* there are usually from 20 to 30 pores altogether, in *H. Persicus* 8 or 10 only.

4. PTYODACTYLUS HOMOLEPIS, sp. nov.

P. affinis P. Hasselquisti, *a quo differt squamis dorsalibus omnibus parvulis subæqualibus, naribus a scuto rostrali disjunctis, et colore griseo, fasciis latis undulatis transversis fuscioribus variato.*

HAB.—*In montibus Khirthar dictis ad fines occidentales provinciæ Indicæ Sind dictæ.*

Description.—The general build and appearance of this gecko are very similar to those of the only other species of the genus as restricted, *P. Hasselquisti.** General form rather elongate, body round, head broad and high behind, wedge-shaped in front, the region in front of the eyes slightly concave. Limbs elongate; the fore-limb nearly reaches the thigh when laid back, laid forward it extends beyond the end of the snout: the hind-limb brought forward comes in front of the shoulder. The only perfect specimen measures rather over $7\frac{1}{2}$ inches, head 1 inch, tail from anus 3·4, or rather less than the head and body.

The nostrils are entirely surrounded by swollen scales, usually 3, but sometimes 4 in number, considerably smaller than the anterior labials. Some of these scales separate the nostril from the rostral and labials. Rostral rectangular, its height rather more than half its breadth, which is more

* *Stellio Hasselquisti*, Schneider; *Ptyodactylus Hasselquisti*, Dum. et Bibr. III, p. 378; *P. gecko*, Gray, Cat. Lizards B. M. p. 151. The name employed by Gray is founded on *Lacerta Gecko*, Hasselquist, which however cannot be applied to this species, as it is not the *Lacerta Gecko* of Linnæus.

than double that of the adjoining labials. Upper labials on each side about 15 or 16. Mental pentagonal, narrower than the adjoining lower labials and very much narrower than the rostral; a row of enlarged chin-shields along the lower edges of the anterior lower labials. No enlarged or pointed scales on the upper eyelid. The whole upper surface of the head, body, limbs, and tail is finely and almost uniformly granular. Scales of the abdomen flat, not imbricate, very little larger than those of the back; those of the chin and throat smaller, except near the lower labials; scales beneath the tail irregularly polygonal, considerably larger than those of the abdomen, not arranged in longitudinal rows. Tail not verticillate. Lower surface of limbs and soles of feet covered with small smooth scales, toes with simple cross plates, except at the extremity, where they are expanded into a double disk marked beneath with radiating striæ; claws retractile, minute, but present on all the toes. No femoral or præanal pores.

Colour (noted on living specimens) light brownish grey with broad transverse wavy bands of lighter and darker shades alternating on the back, tail, and limbs. There are about five darker bands on the back: the cross-bands are closer together on the tail. Lower parts white.

A few specimens of this new gecko were brought to me near the Maki Nai in the lower portion of the Khirthar range, which bounds the province of Sind on the west. The locality whence the types were obtained was in the Mehar division of the Shikárpúr district.

This is, so far as I am aware, only the second species of the genus as restricted by Fitzinger, Gray, Wagler, and others, and the first which has been found in Asia. The other species, *P. Hasselquisti*, which is found in Egypt, is distinguished by having enlarged tubercles on the back, and the nostrils in contact with the first upper labials and rostral.

5. Gymnodactylus, sp.

A species of which I obtained four specimens in the hilly country south-west of Sehwan and again in the hills west of Lárkana appears to differ from *G. Kachhensis* (Stoliczka, P. A. S. B., 1872, p. 79) in having larger abdominal scales; there being about 20 instead of about 30 across the abdomen. As I am not sure if this character is constant (for one of my specimens appears to agree with *G. Kachhensis*), I shall not propose a new name.

I have compared the species from Baluchistán, which I called *G. brevipes* (A. M. N. H., June, 1874, XIII, p. 453), with the types of *G. Kachhensis.* They are quite distinct though allied. The former appears much smaller, darker in colour, and differently marked, and one characteristic distinction is that in *G. brevipes* the nostril is in contact with both the rostral and first labial, whilst in *G. Kachhensis*, it meets the rostral only, being

separated from the first labial by an intervening scale. *G. brevipes* is figured in the 'Zoology of Persia,' Pl. XXII, Fig. 2.

6. Stenodactylus orientalis, sp. nov.

S. arenarius, nonnunquam fusco-transfasciatus, dorso tuberculis parvulis irregularibus fuscis ornato, caudâ robustâ, squamis caudalibus æqualibus, in annulos brevissimos ordinatis, digitis ad latera breviter fimbriatis, subtus scutellis tuberculatis indutis; pupillâ verticali.

Hab.—*In Sind in desertis arenosis.*

Description.—General form stout, somewhat depressed; head flat, short, and blunt; tail slightly swollen at the base, thence diminishing regularly, much stouter than in *S. guttatus*, about the same length as the body without the head; limbs stout, the fore-limb laid forward does not quite reach the end of the snout, the hind-limb extends to the axil. The largest specimen obtained measures 3·3 inches, of which the head is 0·5, and the tail from the anus 1·4.

The nostril is situated at the upper outer angle of the rostral, between that shield and three slightly enlarged scales, one of which separates the nasal orifice from the first upper labial. Rostral rectangular, rather higher than the adjoining labials and about twice as broad; it has a deep vertical groove in the middle which disappears on its lower portion. Upper labials about 12, lower labials 10—13, both series becoming much smaller behind and passing into the head-scales. Mental as broad as the rostral, rounded below; no enlarged chin-shields, but the granular scales near the lower labials are a little larger than those of the throat. Upper eyelid well developed, covered with granular scales; lower eyelid wanting. Pupil vertical. Ear-opening a vertical slit, not quite equal to the diameter of the eye in length. Upper surface of the head, body, and limbs finely granular, over the back there are scattered small convex dark coloured tubercles, none on the limbs. Lower parts covered with small granular scales rather flatter than those of the back, but scarcely larger on the abdomen, and smaller on the throat. Toes short and thick, all of them finely fringed with short pointed denticulations, the lower surface with cross plates each divided into several ribs or tubercles. All the toes furnished with nearly straight claws. Tail finely granular throughout, the granules being disposed in rings.

Colour pale sandy, the tail (and, in one specimen, the body) with darker transverse bands; a darker line from the eye down each side. The enlarged tubercles on the back are dark brown. In one specimen the sides of the snout and labials are mottled with dusky markings.

I obtained one specimen of this gecko in the evening on sand-hills in the desert country south of Rohri in upper Sind. Another was brought to

me in the hills west of the Shikárpúr district. It is evidently a nocturnal species and probably burrows in the sand. It does not appear to be common. It closely resembles a species which I described from Baluchistán under the name of *Bunopus tuberculatus*,* but that form wants the denticulated fringe to the toes. A variety of *B. tuberculatus* has the colouration of the present species.

The other described forms of *Stenodactylus* are African†; *S. guttatus* being found in Egypt, *S. Mauritanicus* in Algeria, and *S. garrulus* in South Africa. Another species has been described under the name of *S. caudicinctus* (A. Dum., Arch. du Mus., VIII, Pl. XVIII, Fig. 15). This last, however, is a very different form, being allied to *Eublepharis*, and Dr. Gray has proposed to make it the type of a distinct genus *Psilodactylus* (P. Z. S., 1864, p. 60). *S. orientalis* is most nearly allied to *S. guttatus*, but it is stouter and has the back tuberculated, and judging from the plate of *S. guttatus* in the 'Description de l'E'gypte' (Supp., Pl. I, Fig. 3) the head in the present species is smaller and the legs much longer, the toes too appear to have a much shorter fringe.

Fam. *AGAMIDÆ.*

7. Agama agilis.

Olivier, Voy. Emp. Othm. Eg. et Perse, II, p. 418, Pl. XXIX, Fig. 1.—Dum. et Bibr., Erp. Gén. IV, p. 496.—Gray, Cat. Lizards B. M. p. 257.—Blyth J. A. S. B. 1854, XXIII, p. 737.—Theobald, Cat. Rept. Mus. As. Soc. p. 38.—Anderson, P. Z. S., 1872, p. 384.—W. Blanf., Zool. Persia, p. 314.

? *Trapelus*, sp. Jerdon, P. A. S. B., 1870, p. 78.

Trapelus megalonyx, Stoliczka, P. A. S. B., 1872, p. 88, *nec* Günther.

Very common in the hills to the west of the Indus valley, as it is in Baluchistán. In the open plain outside the hills it is less frequently met with.

I have examined one of the specimens collected by Dr. Day in Sind, and described by Dr. Stoliczka under the name of *Trapelus megalonyx* and I have no doubt of its belonging to the present species. The appearance of enlarged scales on the sides is, I think, to a great extent fallacious, and due to brighter colour. Certainly there are no scales enlarged to the extent which is found in most species of *Trapelus*, and represented in Ford's figure of *T. megalonyx* in Günther's Reptiles.

* Ann. and Mag. Nat. Hist. June 1874, Vol. XIII, p. 454.— 'Zoology of Persia', p. 348, Pl. XXII, Fig. 4.

† In the Catalogue Méthodique des Reptiles du Muséum d'Histoire naturelle de Paris by C. Dumeril (1851) p. 47, specimens of *S. guttatus* are stated to have been brought from Australia by MM. Quoy and Gaimard. The locality requires confirmation.

The only other *Trapelus* recorded from the British possessions in India is one which Dr. Jerdon mentioned his having obtained from the Alpine Panjáb (P. A. S. B., 1870, p. 78). No specific name was applied to this form, in the description of which I find nothing to distinguish it from *Agama agilis.* The fore-leg is said not to reach the hip joint, as it usually does in this species, but I find that it occasionally falls a little short.

This species was obtained by Mr. Theobald in the Salt range of the Panjáb and I find a specimen in the Indian Museum of which the record of the locality has been lost, but which was presented by Mr. Theobald, and is, I think, probably the specimen mentioned in his catalogue and determined by Mr. Blyth.

8. Trapelus rubrigularis, sp. nov.

T. affinis T. ruderato, *sed squamis omnibus lævioribus, meatu auditorio majori, vix superne denticulato, poris præanalibus paucis atque in seriem unicam ordinatis, coloreque distinguendus; supra olivaceofuscus vel griseus, albido guttulatus, maculis nonnullis fuscis distantibus in lineam longitudinalem utrinque ad dorsum notatus, caudâ superne fuscotransfasciatâ, maculâ rubrâ (post mortem apud exempla in spiritu vini conservata evanescente) sub gulâ signatus.*

Hab.—*In Sind.*

Description.—General form very much like that of *Trapelus ruderatus* from Persia.* The head is short and depressed, so much so in young specimens that they have exactly the appearance of *Phrynocephali,* body much depressed, tail depressed at the base, then very gradually diminishing and terminating in rather a blunt point; no nuchal crest; a cross fold on the throat. The fore-leg in adults when laid back does not reach the thigh, the hind-leg laid forward comes to the shoulder, in young specimens to the ear. Length of the largest specimen collected nearly 7 inches, head 1, tail from anus 3·8, fore-limb to end of toes 1·35, fourth toe without the claw (from the division between 3rd and 4th toes) 0·22, hind limb 2, fourth toe 0·37.

Scales on upper surface of the head bluntly keeled, irregular in size, those in the middle of the occiput and forehead being rather larger than the rest. Superciliary ridge prominent; *canthus rostralis* rounded; nostrils directed upward and backward, each in the middle of a single shield on the anterior portion of the snout; the nasals near each other, being separated by about three scales from each other and usually by two from the ros-

* I have already pointed out (Zool. Persia, p. 316) that the Persian form is the true *Agama ruderata* of Olivier and that the Egyptian lizard, although closely allied, appears to be fairly separable, in which case the latter will stand as *T. mutabilis,* Merrem.

tral. Upper labials square, about 30 to 34 in number, rostral very little broader: mental larger than the rostral. Both eyelids fringed with elongate pointed scales, the upper in front and behind only, the lower throughout. Orifice of ear exceeding the nasal shield in size, the upper edge has a few spinose scales in some specimens, but no long fringe covering part of the orifice; tympanum very little sunken.

Scales of the back smooth or very faintly keeled, subimbricate, arranged in oblique rows, and with some much enlarged scales scattered among them; each enlarged scale is about the size of four ordinary scales, it is pale in colour, often forming the centre of a pale spot, and rather bluntly keeled and pointed behind. These enlarged scales occur also on the basal portion of the tail, but not on the limbs. All the tail-scales are keeled except below near the base, the keels forming longitudinal lines throughout the greater portion of the tail; the scales are not arranged in rings. Scales on the limbs subequal, those above keeled, those beneath smooth, except on the feet, where the scales above are smooth, those beneath the feet and toes sharply keeled. Claws moderate; those on the fore feet very little longer than on the hind, none of them half the length of the thumb without its claw. Scales of the abdomen all smooth, rhomboidal, a single row of about 10 to 12 pores just in front of the anus in males. I count about 120 scales round the body.

Colour above, when alive, olive brown of a paler or darker tint, spotted with pale yellow, each spot corresponding to one of the enlarged dorsal scales. A dusky longitudinal line on each side of the back of the neck, and 3 or 4 pairs of blackish spots of irregular shape at a distance along the back. In some specimens the anterior portion of the shoulder is indigo blue. A large red mark with dusky edges is always found below the throat in living individuals of both sexes, it is more or less concealed by the throat fold and it disappears in specimens kept in spirit. Tail marked above with alternating dusky and pale bands equal in width.

This species is distinguished from all others by its colouration, and, when alive, by the presence of a red patch beneath the throat. It may be easily distinguished from *T. ruderatus* by its much smoother surface, and its scales arranged in regular rows, and from *T. megalonyx* by its shorter claws and by there being little, if any, difference in length between those on the fore and hind feet. It is probably more nearly allied to the Egyptian *T. mutabilis*. Compared with the figure in the 'Description de l'E'gypte' (Supp., Pl. I, Fig. 6), it differs in colouration, in the distribution of the enlarged scales and in their not being spinose. In *T. mutabilis* also there are tubercles on the upper surface of the limbs.

I found this new *Trapelus* not very common on the "Pat" or sandy desert and semi-desert along the base of the Khirthar hills in western Sind.

I obtained very few specimens myself, nearly all were brought to me, and almost all procured were young, only two or three being adult.

9. Stellio nuptus.

Agama nupta, De Filippi, Giornale del I. R. Ist. Lomb. Vol VI, (1843) p. 407.

Stellio carinatus, A. Duméril, Cat. Méth. Rept. Mus. Par. p. 107, (1851).—Archives du Muséum, VIII, p. 580.

S. nuptus, De F., Viaggio in Persia, p. 352.—W. Blanf., Zoology of Persia, p. 317, Pl. XIX, Fig. 1.

This is a fine addition to the fauna of Sind and consequently to that of British India. It is a very different *Stellio* from any of the species found in the Himalaya, the whole back being covered with large carinated scales equal in size and forming oblique rows converging posteriorly, whilst there is an abrupt change to the small scales of the sides. The head is very broad with numerous groups of spines around the ear and on the sides and back of the neck.

The form found agrees in structure with the variety which I have called *fusca*, as it has no fold across the back of the neck, but the prevailing colour is pale yellowish brown as in the type. The largest specimen obtained measures nearly 19 inches, of which the tail is 12½.

I found *S. nuptus* rather scarce in the Khirthar range west of Sind but little above the sea level. It is common throughout southern Persia.

10. Stellio melanura.

Laudakia (Plocederma) melanura, Blyth, Jour. As. Soc. Beng. 1854, XXIII, p. 737.

Stellio melanurus, Anderson, P. A. S. B., 1871, p. 189.—Stoliczka, P. A. S. B., 1872, p. 129.

This species occurs abundantly in the Khirthar range forming the frontier between Sind and Kelat. It grows to a length of 17 or 18 inches, the tail when quite perfect being from two to three times the length of the head and body. In a fine male 15·6 inches long, the tail measured 11·3. In a female 12 in. long, the tail was 8·5. The colour varies: in females it is usually olive mottled with dusky spots and streaks on the head and back; males in the spring are usually more or less black, especially on the tail and hinder part of the back; some are jet black throughout the upper parts, and dusky below.

I am very much in doubt as to whether the Baluchistán *S. liratus* (A. and M. N. H., June, 1874, XIII, p. 453, and 'Zoology of Persia', 320, Pl. XX, Fig. 2) should be considered distinct, most of the characters which I thought would serve to separate it being found at times in *S. melanura.* The dorsal scales do appear rather smaller in the latter, there being 10 to 12 of the enlarged rows in the middle of the back instead of 6 or 7, but the fold across the back of the neck is occasionally well developed, and the extent to which the tail-scales near the base are keeled varies in individuals,

and so does the regularity of annulation. Some have the tail scales arranged in verticils, in others this character is obscure or wanting, and it is rarely well marked.

In adult males there is a patch of thickened scales in the middle of the abdomen as in some other forms of *Stellio*.

Fam. *LACERTIDÆ.*

11. Mesalina pardalis.

Lacerta pardalis, Licht., Verzeich. Doubl. p. 99.*
Eremias pardalis, Dum. et Bib., V. p. 312.
Mesalina pardalis, Gray, Cat. Lizards B. M. p. 43.—W. Blanf., Zool. Persia, p. 377.
Eremias (Mesalina) Watsonana, Stoliczka, P. A. S. B., 1872, p. 86.

In the 'Zoology of Persia,' I pointed out that the specimens of this species obtained by me in various parts of Persia, agreed perfectly on the one hand with typical examples from Egypt in the British Museum and on the other hand with Dr. Stoliczka's description of *M. Watsonana*. A typical specimen of the latter is in the Indian Museum, and I find my identification was quite correct, and that this specimen agrees in all respects with *M. pardalis*.

This species is common in the western part of upper Sind, keeping chiefly to open plains and deserts.

12. Acanthodactylus Cantoris.

Common in open sandy places, usually amongst bushes, not in absolute desert.

13. Ophiops Jerdoni.

This is not common in Sind, but I saw several on the top of a high hill, called Miagwan, in the extreme north-western corner of Sind, at an elevation of about 6000 feet above the sea; I also met with a few individuals on the Hab river near Karáchi. Concerning this species see Stoliczka's remarks, J. A. S. B., 1872, XLI, p. 89, and Günther's, P. Z. S., 1875, p. 225. The latter, however, is mistaken in supposing that *Cabrita Jerdoni* is the same species. As was pointed out by Beddome in his original description (Mad. Monthly Jour. Med. Sci. 1870), *C. Jerdoni* differs in having a fully developed lower eyelid, a longer tail, more numerous femoral pores, &c.

* I take this reference from Dumeril and Bibron and from Gray, as I have not access at present to the original work. There is no doubt, so far as I am aware, about the identification, but it is never wise to quote any authority without referring to it, and I only do so in this case because the species has not before been recognized as Indian.

III.—*On certain protracted Irregularities of Atmospheric Pressure in the Indian Monsoon-region, and their Relation to Variations of the Local Rainfall.*—*By* HENRY F. BLANFORD, *F. G. S.*

(Received May 13th;—Read June 7th, 1875.)

Note.—The greater part of the following paper was written in 1874 for communication to the British Association meeting at Belfast, and an abstract of the paper appears in the Reports of the work of Section A for that year. I did not, however, publish the paper in extenso, as I desired before doing so to verify the conclusions by some further experience. The original paper discussed the phenomena of the years 1868, 1871, 1872, and 1873: I have now added those of 1869, 1870, and 1874; and I have re-drawn the tables of the former years, substituting as the standard of comparison, the averages obtained up to the end of 1874, for those up to the end of 1873 only. The result has been a further confirmation of at least one of my conclusions, *viz.* the persistency of certain anomalies of pressure distribution. The other conclusion suggested, *viz.* that the rainfall of each season is influenced in a characteristic manner by these anomalous variations of the pressure, is one that requires for its verification a far more detailed and prolonged study than the data here given will admit of.

In a paper read in February 1874 before the Royal Society, I concluded from a detailed discussion of the wind-directions, and the distribution of atmospheric pressure in Northern and Central India, as well as of other meteorological elements, that the Indian branches of the two monsoons, in the one case originate, in the other terminate south of the Himalaya; and that they are but little, if at all, dependent on the variations of atmospheric pressure in Central Asia, to which they have generally been attributed. The great mountain chain acts in fact as a complete barrier to the lower half of the atmosphere, and it was shewn that it is within this stratum that the alternating air-currents are restricted. From April to the end of September an area of low pressure exists over a part of Central India and the Punjab, towards which a tolerably steady current blows from equatorial seas; while, during the remainder of the year, there is an area of less intense maximum pressure in approximately the same region, in which the winter or NE monsoon originates. In the charts given in illustration of this paper, it was shewn that the position of the barometric minimum in the SW monsoon, on an average, changes but little from the month of May, before the rains set in, up to the end of the rains in September or October; when the pressure becomes nearly uniform, prior to the re-distribution which characterises the winter season. The object of the present paper is to shew that while

the distribution of relative pressures during the SW monsoon deviates somewhat from the normal or average type in certain years, the variations which appear at the beginning of the season in April or May are almost, if not quite, as persistent as the normal features of distribution shewn in the charts; and sometimes, indeed, last through one or two years. This fact is one which may prove hereafter of much practical importance. Since the strength and direction of the winds are determined by differences of pressure in neighbouring regions, and since the monsoon rains are in their turn dependent on the vapour-bearing winds, it might be expected that the anomalies of rainfall would also shew a certain persistence, and that each season, and, in certain cases, two seasons in succession, would preserve much the same character in regard to the excess or deficiency of rainfall. As far as observation hitherto has afforded the means of testing this presumption, this appears to be actually the case; the result being sometimes a succession of destructive floods, at other times the failure of the late autumn crops over large areas, producing those famines for which India is disastrously notorious.

Until about eight years ago there were no systematic records of meteorological phenomena in India, sufficiently general for instituting an enquiry into a question of this kind: and even up to last year, those that are trustworthy and at the same time accessible, related only to about a third of the whole area of India. It is therefore for this portion only that evidence is at present forthcoming. But fortunately this includes the greater part of the area which is concerned with that branch of the monsoon that traverses the Bay of Bengal in the summer months; the remainder being chiefly watered either by the current which proceeds from the western coast; or, in the case of the Carnatic, by the Bay of Bengal current which is deflected towards that region in October and November.

With such partial data as have hitherto been available, it is certainly not possible to establish definite laws of the relations between the quantity and distribution of the rainfall on the one hand, and local irregularities in the distribution of pressure on the other. To do this effectually will require much more complete data than we at present possess; including a knowledge of the distribution of atmospheric pressure over the whole of India and the neighbouring seas;* and more perfect means of determining the absolute movement of the air,† its temperature and humidity, than are at present available. I shall therefore content myself in this place with

* This, it is hoped, will be shewn for the first time in the Report on the Meteorology of India for 1875, by means of isobaric and wind-charts for each month of the year.

† Steps have been taken to procure self-recording anemometers for this purpose, which will be erected at some 20 stations in addition to the three presidency capitals; which are already provided with them.

adducing evidence to shew that abnormal variations of relative pressure tend to be persistent; and on the former head I shall only point out some observed coincidences, with the caution that no satisfactory discussion of this subject is practicable until the conditions are known over a very much wider area than that treated in the present paper, and that for a sufficiently long period.

When the barometric traces of a number of stations in different parts of India are compared together, it appears that, after eliminating the regular variation of the daily tides, they are all affected simultaneously or nearly so by irregular fluctuations of very various duration (from one to many days), and that these are on the whole more intense at northerly than at southerly stations. The amount by which the pressure at any place for a given month or day deviates above or below its normal value for that period, will necessarily be affected by these irregular fluctuations as well as by those protracted anomalies of pressure with which I am now concerned. The most ready way of exhibiting the latter is to take the barometric difference for the period in question of a pair of stations, not too distant from each other, and from this to deduct their normal or average difference for the corresponding period; or, what comes to the same thing, to obtain the total barometric anomaly* for each of the pair separately, by deducting the corresponding normal values, and then to take the difference of these anomalies. This latter method will be followed in the tables illustrating this paper. If we find that as a general rule these final differences or, as I have termed them, *relative anomalies* preserve the same sign + or — and not infrequently approximately similar values for many months together (the comparison being sufficiently extensive fairly to test the whole mass of the data), the proposition that abnormal variations of relative pressure tend to be protracted, may be considered as established. I must, however, remark by way of precaution, that the above method of proceeding does not completely eliminate the general irregular fluctuations. It would do so, only if all stations were equally affected by them; but actually this is not the case. A simple inspection of the barometric curves (of which I have a series for several years) shews that, as a rule, these fluctuations are more intense, the higher the latitude; and that, sometimes, stations in the interior seem to be more affected than those on the coast. Hence the further two stations are apart (especially in latitude), the less complete is the elimination. But for my present purpose this rough method will suffice. I now proceed to the facts.

In 1868 an abnormal barometric depression in the NW corner of the Bay of Bengal and in part of Orissa characterised the whole of the SW

* By this term, I designate the amount by which the mean pressure at any station for a given day, month, or year, ranges above or below the corresponding average of many years.

monsoon, while in Lower Bengal the pressure was for the most part above the average. This is shewn in the tables for the year [*see* Appendix]; the first of which gives the mean total barometric anomaly for each month of Calcutta, Saugor Island, False Point, Cuttack, Chittagong, and Akyab, and the second the relative anomalies for certain pairs of stations selected so as best to illustrate the phenomenon in question.

In this case, which indeed was the first that attracted my attention, the relative depression was remarkably intense, and bounded (on the land side at least) by a high gradient. The pressure in Bengal was unusually high and that at False Point abnormally low at the beginning of the year; and this barometric difference was intensified in May, when, however, there was a prevalent high pressure much exceeding the average. In June, again, when the general pressure was below the average, the difference was less, and as between the neighbouring stations of Cuttack (50 miles from False Point) and Calcutta, almost disappeared; reappearing, however, in July with a general excess of pressure, and becoming further intensified in August with a general and abnormal fall. In this last month the greatest difference was between Saugor Island and Calcutta (68 miles apart); amounting absolutely to not less than ·103 inches on the mean pressures of the month. There was no cyclone, notwithstanding that so great a barometric gradient rarely occurs, even temporarily in India, except during the passage of a cyclone. The rainfall at Calcutta during the month was however very heavy, one half greater than at Saugor Island, and at Hooghly 30 miles further north it was nearly twice as great as at Calcutta. I shall recur to this subject in the sequel. In the north-west of the Bay, the anomalous depression lasted until the end of the year; but it was most intense during the south-west monsoon. The excessive rainfall was quite local, and occurred, as we have seen, some distance to the north of the depression. In the N. W. Provinces the fall of the season was somewhat deficient.

In 1869 the pressure was abnormally high at False Point and Cuttack (especially the former), relatively to the more southern part of the coast (Madras) on the one hand, and to Bengal, especially as represented by Berhampore on the other. It was abnormally low at Berhampore and also at Chittagong; while at Akyab, relatively both to this place and Port Blair, and during the greater part of the monsoon, even to False Point, it was unusually high; August being a temporary exception. In other words, there seems to have been an abnormal ridge of high pressure, extending across the Bay from Akyab to False Point and Cuttack. In the Meteorological Report for that year it is stated that "the rainfall was less than the average in Orissa, the Gangetic delta, and Aracan. Also in Eastern Bengal (except Sylhet and Cherrapunji), in Lower Assam, Sikkim, and parts of Behar. It was above the average at Soory and Berhampore, and over a

tract of country stretching between the Rajmahal hills and the Bhotan dwars, including Dinajpur, Rangpur and probably Julpigori and Buxa." Hence it appears that the ridge of relatively high pressure, before adverted to, had the effect of diminishing the rainfall generally both in the region occupied by it and also to the north; except where the abnormal depression at Berhampore and Chittagong tended to negative this effect and produce a local increase. Quoting again from the Report of the year, "it would appear that the area of greatest rainfall did not coincide with that of the barometric depression but was at 150 miles to the north-east of it. It was very restricted, and if the data can be trusted in detail would seem to be sharply defined."

The local relative excess of pressure at False Point and Cuttack was maintained through the cold weather of 1869—70, and up to the end of the latter year; except at Cuttack, where it fell in December. The same was the case at Akyab, except temporarily in the month of May [*see* Tables]. Its total duration extended therefore over two entire years. At False Point, however, the barometer stood abnormally in excess of Akyab, during the earlier months of the year and also in August and December. The region of most persistent depression was about the Andamans,* and the relative depression at Chittagong, Berhampore, and Monghyr was maintained, though less intense than in the previous year. At Jubbulpore the pressure was abnormally high, relatively to Nagpur, during the hot weather; but this relation was reversed in August, and at the end of the year, the pressure at the latter station ranged greatly above that at the former.

In the Bengal Report for this year it is stated that "In the Central Provinces, including Sambhalpur and the hilly country to the West of the Gangetic delta, the rainfall was higher than usual; while the Orissa coast tract and the Gangetic delta had less than the average, more especially along a line passing through False Point, Midnapur, and Burdwan", that is to say under the lea of the high pressure region about False Point. "The stations in Behar registered about the usual quantity; in some cases much more;" this being under the lea of the relative depression about Monghyr. "In Eastern Bengal and Arakan the rains were generally somewhat deficient, except at Sylhet and Noakhally"; and it is observed that "some of these local irregularities appear to be very anomalous."

I next come to the year 1871, one of unusually heavy rainfall in Bengal (except the Eastern districts and Lower Assam) and also in the NW Provinces and Central India. In this year, the pressure was abnormally low in the eastern part of the Bay about Akyab, in Orissa, and in Central India north of the Sátpúra range; as compared with Bengal, the Gangetic valley, and the tract to the South of the Sátpúras. On the west coast (the In-

* In January a cyclone occurred in the extreme South of the Bay.

dian coast) of the Bay, especially about False Point, the pressure was still relatively high, so that the two areas of abnormally low pressure, *viz.* that on the East of the Bay and that of Orissa, were distinct and separated. The Akyab depression did not extend to Port Blair (Andamans), where the pressure was on the whole slightly in excess of the average. To shew these differences, in the Table for 1871 I have compared in the same manner as before, Akyab with Chittagong on the north and Port Blair on the south; False Point with Vizagapatam, and this with Madras on the south and with Berhampore on the north; also with Akyab on the east and Cuttack on the west; Cuttack with Berhampore, Monghyr, and Jubbulpore; and Jubbulpore with Benares on the north and Nagpore on the south. Also Berhampur with Monghyr and Chittagong.

The general persistency of the relative baric anomalies of the season is well shewn in the table. But it exhibits some interruptions; as for instance a sudden relative depression at False Point, Vizagapatam, and Cuttack in June, coinciding indeed with a general fall below the average, but most intense at those stations. The rainfall in this month was exceptionally heavy in the Gangetic delta, especially in the neighbourhood of Calcutta, where it was about twice as great as at Saugor Island; thus repeating the conditions already noticed in 1868. Another noticeable interruption is a rapid rise of pressure at Jubbulpore in October, which was partially felt at Nagpore and Benares, but not at all in Orissa; while in Lower Bengal there was a fall of pressure. Fluctuations in the amounts of the relative anomalies, of less magnitude are indicated throughout, as might indeed be expected; but they are for the most part gradual and not such as to negative the general truth of the law of persistency.

The next year, 1872, was one of light rainfall in Bengal generally (that of every month being below the average); but it was excessive in Orissa and Chutia Nagpore. It was also stormy in the Bay of Bengal, which was not the case in 1871. In the N. Western and Central Provinces the rainfall was either about the average or somewhat above it; this was chiefly due to the heavier fall of the later months of the monsoon. Both in the N. W. Provinces and Behar, the hot weather months with June and July were generally dry, and rain did not fall plentifully till August. The anomalous barometric depression in the neighbourhood of Akyab, and in Orissa as compared with stations to the North was greater than in 1871; but Akyab did not on the whole range abnormally below Port Blair, nor did Jubbulpore range unusually below Nagpore on the one hand and Benares on the other, as in the previous year; while an abnormal depression in the N. West of the Bay connected the Orissa and Akyab depressions, being greatest about False Point, or possibly in the neighbouring part of the Bay. To shew this distribution I give tables for the same stations as in the previous year,

with the addition of Agra, Jhansi, and Lucknow in the N. W. Provinces, these latter being chiefly for comparison with the corresponding data of 1873, when there was an important barometric irregularity in the Upper Provinces.

In the table the general persistency of the baric anomalies is clearly shewn, but there are three interruptions of some importance. In May with a general fall greater than the average, especially in Central India and False Point, Jhansi in the interior and Port Blair were exceptions, the fall there being slightly less than the average. Again, in June, when the pressure generally was considerably above the average, Orissa and Port Blair changed in the opposite direction. Lastly, in September, with an unusual rise of pressure every where, this was most intense at False Point and Jubbulpore, and was but little in excess of the average at Port Blair, Vizagapatam, and Madras.

I now come to the year 1873, the rainfall of which in most parts of Northern India was much below that even of the previous year, causing that deficiency of the crops in parts of Bengal and the N. W. Provinces which is still fresh in the recollection of all. The baric anomalies of the year were in some respects identical with those of 1872, having lasted through all the revolutions of the changing monsoons, but they were accompanied by others which made their appearance either in the latter part of that year or the earlier months of 1873, thus rendering the barometric distribution in the summer monsoon more anomalous than that of any year yet recorded.

The anomalous depression in the Northern part of the Bay of Bengal and Orissa still continued: Akyab as compared with Chittagong and False Point as compared with Vizagapatam and Madras were lower even than in 1872: and the Orissa depression, relatively to Bengal and the Central Provinces, was as great, in some cases greater than in the previous year. With regard to the south-east of the Bay, as represented by Port Blair, the Akyab depression was somewhat greater than in 1872, but the registers of a station, established during the year, in the Nicobars, seem to shew that to the south of the Andamans there existed a very considerable barometric depression, which must have greatly influenced the strength of the monsoon in the Bay of Bengal, and which was probably abnormal, though in the absence of earlier registers, this cannot be confidently asserted.

In the upper part of the Ganges valley, in the province of Oude, a very unusual depression appeared in the later months of 1872 and lasted up to the close of the monsoon of 1873. These facts are shewn in the tables for the year at the end of this paper.

As in the previous years, the tables shew a general persistence of the relative anomalies, with some interruptions, traceable to the unequal incidence of general temporary fluctuations. Thus, in February, when the

5

pressure generally became about normal after an unusual depression in January, the change affected the several stations very unequally, Orissa and the upper part of the N. W. Provinces being most affected, and Jubbulpore and Madras the least. In May, again, the pressure fell much less than usual as a general rule, but at Akyab the fall was of the almost normal amount; while at Agra and Lucknow it was less than the average fall by nearly 0·1 inch. In June the fall of pressure was everywhere greater than the average, the excess being greatest at Agra and Lucknow, and least at Akyab, Madras, and Nagpore. Lastly, in August, with a general abnormal rise of pressure, Akyab, Chittagong, Berhampur, and Monghyr show the greatest excess, and Agra and Lucknow nearly as much, but the rise at Madras was not much greater than the average, and at Port Blair, Vizagapatam, and Nagpore about equal and of intermediate amount.

In 1874 the pressure was abnormally low relatively to other places at at Akyab, False Point, and Cuttack, especially the last; while it was highest at Berhampur and Chittagong.

Agra and Lucknow (especially the last) shewed a low pressure as in the preceding year; but the depression was relatively less intense; and Jhansi and Jubbulpore were relatively high, more especially the latter. The persistency of these differences was not less than in former years, as may be seen in the table for 1874; but I have not been able to trace out any such concurrence between these phenomena and the peculiarities of the rainfall as are exhibited in the reports and registers of certain previous years. The rainfall of 1874 was generally deficient in the western districts of Bengal and also the more eastern districts and Arakan; but above the average at Burdwan, Soory, Contai, and in the Rajshaye and Cooch Behar divisions. In general, too, it was in excess in Behar, Chutia Nagpur, and Orissa. In the N. W. and Central Provinces also it was generally abundant; Jhansi, Ajmere, and Nagpore being, however, exceptions. In the earlier part of the monsoon, the rain was plentiful in the N. W. Provinces and scanty in Bengal. In September and October this relation was reversed.

Lest the somewhat abstract language I have employed in describing these phenomena should tend to obscure the physical facts to which the tables testify, it will be useful, before proceeding further, to recall to mind what these facts really are. Such expressions as *normal* and *abnormal*, however convenient for describing the mental analysis of a phenomenon which results from the concurrent operation of a number of causes, have really reference only to our way of regarding it, and none whatever (of necessity) to the phenomenon itself. The physical facts educed in the foregoing discussion may be thus enunciated:—That amid the never ceasing changes of condition and place to which every

part of the atmosphere is subject, certain states tend to perpetuate or reproduce themselves in the same region, in such manner as to maintain a constant difference in the mean or average pressures of two neighbouring regions; and that this tendency to a constant local difference is in certain cases maintained throughout those great revolutions of atmospheric density, composition, and movement which accompany the alternations of the monsoons. Nevertheless these states though protracted are not permanent, and disappear after a longer or shorter time. Sometimes suddenly, but more frequently by a graduated decrease.

When this class of phenomena first attracted my attention, my first idea was, as would probably occur to most, that the instruments used for measuring the pressure had either become defective, or had been displaced from the vertical position or moved to a different elevation, without the fact having been reported. I accordingly had the instruments recompared and ascertained by careful enquiry whether any removal had taken place, but failed to obtain any explanation of the observed anomalies. Longer experience has shewn that two or more neighbouring stations, occasionally participate in the same condition of protracted excessive or deficient pressure ; and where stations exist intermediate in position between those at which extreme opposite conditions prevail, the former continue to shew an intermediate condition. I should add that, as far as regards Bengal, I have given the utmost care to ensure that all barometric observations shall be rigorously comparable, and after a careful consideration of all the circumstances, I am able to see no reason to doubt the validity of the phenomena indicated by the registers.*

* The most remarkable case of protracted differences of pressure, which are nevertheless not permanent, is that shewn by False Point and Cuttack, as compared with the surrounding stations. The registers shew that after remaining abnormally low throughout the year 1868, the pressure rose at the beginning of 1869 and at False Point remained unusually high throughout the years 1869, 1870, and 1871. At the beginning of 1872 it again fell, and remained relatively low during the two years following. Now at False Point the same instrument (a marine barometer of the Fitzroy pattern) was used continuously by the same observer, and, I am assured, in the same place, from the time when the station was originally established up to the end of 1872; it was then replaced by a marine barometer on the Kew principle, without any change in the general value of the readings. At Cuttack the original instrument was replaced towards the end of 1869, but the two were read simultaneously for a fortnight, and, after applying the corrections which had been previously determined in Calcutta, the readings were found to be identical. The second instrument was again replaced in December 1872 by a Casella's standard, which was

If then, as I cannot but conclude, the distribution of pressure in India is subject to protracted local variations, which nevertheless are not permanent, it seems probable that we may find herein a clue to the explanation of those irregularities of the rainfall that have so important an influence on the welfare of the people; and the connection between the two classes of phenomena must become a question of very high practical as well as scientific importance.

I have already shewn reasons why this enquiry cannot be satisfactorily undertaken at present. For instance, the establishment of an observatory at the Nicobars in May 1873, brought to light the apparent existence of a remarkable barometric depression in that neighbourhood, of which we should otherwise have remained in ignorance. What its extent may have been, we do not know, but its position is such that it must have been influential in drawing aside a portion of the monsoon current which otherwise would pass up the Bay towards Northern India. So long as we remain without information of the meteorological conditions in any part of the Indian monsoon area, we cannot be sure that the effects we witness in Northern India may not have resulted from causes whose seat lies without our area.

But although any comprehensive discussion of the subject is impossible, I may point to some observed relations between barometric depression and rainfall which are, I think, too striking to be a fortuitous coincidence. I refer more especially to the excessively heavy rainfall which occurred in the region of which the town of Hughli is the centre, in August 1868; when a very intense depression lay near Saugor Point (100 miles to the south) off the mouth of the Hughli. In the previous month of June, when the site of the minimum pressure was in the neighbourhood of False Point, the region of excessive rainfall lay about Balasore and Contai (100 miles to the north), and throughout the season, while the barometric depression held its place in the N. W. corner of the Bay, the excessive rainfall was restricted to the south-west corner of the Gangetic delta, although the fall was heavy over a considerable part of the delta. In Behar on the other hand, and in

fixed in position by myself, and a second series of simultaneous readings for a month, gave, after due correction, the same results. The instrument had been moved to a different house, I believe in 1870; but a line of levels taken at my request by the Executive Engineer of the station shewed that the two positions of the instrument were appreciably at the same level. The Saugor Island barometer which in 1868 shewed as great a fall below the usual pressure as that of False Point, has been compared three times, *viz.* when first supplied to the station, again by myself on the spot at the end of 1870, and lastly with a Casella's standard supplied to the station in 1873. The results of these comparisons agreed accurately, and the instrument has always been in the same position.

the N. W. Provinces, the rainfall of this year was deficient. I may here point to a parallelism between this case and that of the rainfall in cyclones, in which it appears, by the common consent of observers, that the greatest rainfall occurs in advance of the cyclone-centre.

Now something similar to the above relation seems to be traceable in other cases when the depression is less intense and the effect more extensive. In 1873, although the fall was deficient in Bengal and the N. W. Provinces, it was not so in the Punjab nor about Roorkee and Agra, which lay to the west or north-west of the abnormal depression in Oude; that is to say, beyond the depression, in the course followed by the vapour-bearing winds. It was very copious also in Burmah, which lay beyond (to the north and north-east of) the Nicobar depression, the monsoon-current here being from the south-west. In 1871, when there was an abnormal depression in the east of the Bay, in Orissa, and about Jubbulpore; (how far this last may have extended east and west we do not know, in the absence of stations); the rainfall was abundant in the Gangetic valley and Bengal, as well as the Central Provinces. But on the other hand, we must not lose sight of the fact, that in 1872 and 1873, when the depression was as great or greater in the Bay of Bengal and Orissa, the rainfall in Bengal as in Northern India generally was light or very deficient. This fact warns us that we must not push too far the conclusions drawn from our present imperfect data.

The mean or normal values adopted as standards in the following tables are those of all registers up to the end of 1874. The number of years in each case is from 5 to 8. The table of these values is given at page 15 of the Meteorological Report for Bengal for the year 1874.

1868. *Table of total barometric Anomalies.*

	Calcutta.	Sagar Id.	False Pt.	Cuttack.	Chitta-gong.	Akyab.
January,	+ ·024	+ ·016	— ·036	— ·013	— ·004	— ·032
February,	+ ·011	— ·039	— ·043	— ·001	— ·011	— ·007
March,	+ ·026	— ·010	— ·035	+ ·004	— ·009	— ·001
April,	+ ·008	— ·032	— ·059	— ·011	— ·025	+ ·018
May,	+ ·102	+ ·054	0	+ ·063	+ ·045	+ ·072
June,	0	— ·043	— ·044	— ·002	— ·035	+ ·047
July,	+ ·035	— ·020	— ·044	+ ·004	— ·001	+ ·049
August,	— ·020	— ·128	— ·085	— ·088	— ·067	— ·013
September,	0	— ·072	— ·072	— ·004	— ·016	+ ·011
October,	+ ·034	— ·021	— ·013	+ ·046	+ ·016	+ ·009
November,	— ·014	— ·049	— ·059	— ·010	— ·034	— ·068
December,	+ ·027	+ ·012	— ·021	+ ·020	+ ·004	+ ·002

1868. *Table of relative barometric Anomalies.*

	Sagar Id. to Calcutta.	False Pt. to Calcutta.	Cuttack to Calcutta.	False Pt. to Cuttack.	False Pt. to Akyab.	Akyab to Chittagong.
January,	— ·008	— ·060	— ·037	— ·023	— ·004	— ·028
February,	— ·050	— ·054	— ·012	— ·042	— ·036	+ ·004
March,	— ·036	— ·061	— ·022	— ·039	— ·034	+ ·008
April,	— ·040	— ·067	— ·019	— ·048	— ·077	+ ·043
May,	— ·048	— ·102	— ·039	— ·063	— ·072	+ ·027
June,	— ·043	— ·044	— ·002	— ·042	— ·091	+ ·082
July,	— ·055	— ·079	— ·031	— ·048	— ·093	+ ·050
August,	— ·108	— ·065	— ·068	+ ·003	— ·072	+ ·054
September,	— ·072	— ·072	— ·004	— ·068	— ·083	+ ·027
October,	— ·055	— ·047	+ ·012	— ·033	— ·022	— ·007
November,	— ·035	— ·045	+ ·004	— ·049	+ ·009	— ·034
December,	— ·015	— ·048	— ·007	— ·041	— ·023	— ·002

1869. *Table of total barometric Anomalies.*

	Port Blair.	Akyab.	Chittagong.	Madras.	False Pt.
January,	+ ·101	+ ·053	+ ·037	+ ·038	+ ·060
February,	+ ·048	?	+ ·001	+ ·007	+ ·040
March,	+ ·020	+ ·010	— ·020	— ·006	+ ·052
April,	+ ·021	+ ·008	— ·026	— ·005	+ ·040
May,	+ ·021	+ ·014	— ·015	— ·010	+ ·042
June,	— ·011	— ·039	— ·054	— ·034	— ·003
July,	+ ·002	+ ·004	— ·020	— ·019	+ ·019
August,	+ ·010	+ ·041	+ ·033	— ·013	+ ·058
September,	+ ·006	+ ·029	— ·020	— ·008	+ ·021
October,	— ·003	+ ·006	— ·037	— ·012	+ ·014
November,	+ ·015	+ ·025	+ ·012	— ·009	+ ·048
December,	+ ·004	?	— ·034	— ·056	+ ·008

	Cuttack.	Berhampore.	Monghyr.	Nagpore.	Jubbulpore.
January,	+ ·052	+ ·056	+ ·039	— ·001	+ ·046
February,	+ ·038	+ ·016	+ ·001	— ·045	+ ·008
March,	+ ·039	— ·018	+ ·013	— ·049	— ·020
April,	+ ·021	— ·050	?	— ·034	— ·007
May,	+ ·019	— ·005	?	— ·049	— ·025
June,	— ·041	— ·151	— ·030	— .049	— ·002
July,	+ ·015	— ·058	+ ·006	— ·019	+ ·011
August,	+ ·055	+ ·038	+ ·014	— ·010	+ ·046
September,	— ·005	— ·008	— ·022	— ·052	— ·036
October,	+ ·006	— ·011	+ ·004	— ·036	— ·058
November,	+ ·037	+ ·011	+ ·034	+ ·018	— ·017
December,	+ ·025	— ·046	— ·016	— ·046	— ·032

1869. *Table of relative barometric Anomalies.*

	Akyab to Port Blair.	Akyab to Chitta-gong.	False Pt. to Mad-ras.	False Pt. to Cut-tack.	False Pt. to Ber-hampore.	Cuttack to Jubbul-pore.
January,	— ·048	+ ·016	+ ·022	+ ·008	+ ·004	+ ·006
February,	?	?	+ ·033	+ ·002	+ ·024	+ ·030
March,	— ·010	+ ·030	+ ·058	+ ·013	+ ·070	+ ·059
April,	— ·013	+ ·034	+ ·045	+ ·019	+ ·090	+ ·028
May,	— ·007	+ ·029	+ ·052	+ ·023	+ ·047	+ ·044
June,	— ·028	+ ·015	+ ·031	+ ·038	+ ·148	— ·039
July,	+ ·002	+ ·024	+ ·038	+ ·004	+ ·077	+ ·004
August,	+ ·031	+ ·008	+ ·045	+ ·003	+ ·020	+ ·009
September,	+ ·023	+ ·049	+ ·013	+ ·026	+ ·029	+ ·031
October,	+ ·009	+ ·043	+ ·026	+ ·008	+ ·025	+ ·064
November,	+ ·010	+ ·013	+ ·057	+ ·011	+ ·037	+ ·054
December,	?	?	+ ·064	— ·017	+ ·054	+ ·057

	Cuttack to Mon-ghyr.	Jubbul-pore to Nagpore.	Berham-pore to Mon-ghyr.	Berham-pore to Chitta-gong.	False Pt. to Akyab.
January,	+ ·013	+ ·047	+ ·017	+ ·019	+ ·007
February,	+ ·037	+ ·053	+ ·015	+ ·015	?
March,	+ ·026	+ ·029	— ·031	+ ·002	+ ·042
April,	?	+ ·027	?	— ·024	+ ·032
May,	?	+ ·024	?	+ ·010	+ ·028
June,	— ·011	+ ·047	— ·121	— ·097	+ ·036
July,	+ ·009	+ ·030	— ·064	— ·038	+ ·015
August,	+ ·041	+ ·056	+ ·024	+ ·005	+ ·017
September,	+ ·017	+ ·016	+ ·014	+ ·012	— ·008
October,	+ ·002	— ·022	— ·015	+ ·036	+ ·008
November,	+ ·003	— ·035	— ·023	— ·001	+ ·023
December,	+ ·041	+ ·014	— ·030	— ·012	?

1870. *Table of total barometric Anomalies.*

	Port Blair.	Akyab.	Chitta-gong.	Madras.	Vizaga-patam.	False Pt.
January,	— ·159	?	— ·072	— ·083	— ·098	— ·010
February,	— ·042	— ·015	— ·042	— ·034	— ·052	+ ·029
March,	— ·032	— ·017	— ·050	— ·022	— ·021	+ ·017
April,	— ·024	— ·014	— ·038	— ·031	— ·007	+ ·019
May,	— ·032	— ·041	— ·014	— ·057	— ·045	— ·044
June,	— ·004	+ ·064	+ ·063	+ ·005	+ ·037	+ ·068
July,	— ·023	+ ·007	— ·020	— ·008	— ·019	— ·007
August,	— ·037	— ·021	— ·023	— ·007	— ·009	+ ·008
September,	— ·019	+ ·026	+ ·014	+ ·001	— ·007	+ ·036
October,	— ·006	+ ·028	— ·004	+ ·007	+ ·004	+ ·028
November,	— ·012	+ ·005	— ·028	+ ·008	— ·017	+ ·001
December,	— ·069	+ ·002	— ·009	+ ·020	+ ·013	+ ·036

1870. *Table of total barometric Anomalies.*

	Cuttack.	Berham-pore.	Mon-ghyr.	Jubbul-pore.	Nagpore.
January,	— ·033	— ·063	— ·028	— ·085	— ·055
February,	+ ·015	— ·034	— ·004	+ ·008	+ ·001
March,	+ ·019	— ·027	— ·003	+ ·039	+ ·004
April,	+ ·020	+ ·003	+ ·017	+ ·009	— ·023
May,	— ·052	— ·065	— ·066	+ ·013	— ·027
June,	+ ·038	+ ·064	+ ·024	+ ·036	+ ·037
July,	— ·021	— ·028	— ·032	+ ·007	— ·015
August,	+ ·016	— ·019	— ·003	— ·037	+ ·006
September,	+ ·022	— ·001	+ ·001	+ ·005	+ ·024
October,	+ ·006	— ·011	— ·015	— ·034	— ·003
November,	— ·013	— ·018	— ·024	— ·034	+ ·010
December,	— ·060	— ·007	— ·006	— ·003	+ ·072

1870. *Table of total barometric Anomalies.*

	Akyab to Port Blair.	Akyab to Chitta-gong.	Vizaga-patam to Madras.	False Pt. to Viza-gapatam.	False Pt. to Cut-tack.	False Pt. to Ber-hampore.
January,	?	?	— ·015	+ ·088	+ ·023	+ ·053
February,	+ ·027	+ ·027	— ·018	+ ·081	+ ·014	+ ·063
March,	+ ·015	+ ·033	+ ·001	+ ·038	— ·002	+ ·044
April,	+ ·010	+ ·024	0	+ ·034	— ·001	+ ·016
May,	— ·009	— ·027	+ ·012	+ ·001	+ ·008	+ ·021
June,	+ ·068	+ ·001	+ ·032	+ ·031	+ ·030	+ ·004
July,	+ ·030	+ ·027	— ·011	+ ·011	+ ·014	+ ·021
August,	+ ·016	+ ·002	— ·002	+ ·017	— ·008	+ ·027
September,	+ ·045	+ ·012	— ·008	+ ·043	+ ·014	+ ·037
October,	+ ·034	+ ·012	— ·003	+ ·024	+ ·022	+ ·039
November,	+ ·017	+ ·033	— ·025	+ ·018	+ ·014	+ ·019
December,	+ ·071	+ ·011	— ·007	+ ·023	+ ·096	+ ·043

	Cuttack to Jub-bulpore.	Cuttack to Mon-ghyr.	Berham-pore to Mon-ghyr.	Berham-pore to Chitta-gong.	Jubbul-pore to Nagpore.	False Pt. to Akyab.
January,	+ ·052	— ·005	— ·035	+ ·009	— ·030	?
February,	+ ·007	+ ·019	— ·030	+ ·008	+ ·007	+ ·044
March,	— ·020	+ ·022	— ·024	+ ·023	+ ·035	+ ·034
April,	+ ·011	+ ·003	— ·014	+ ·035	+ ·032	+ ·033
May,	— ·065	+ ·014	+ ·001	— ·051	+ ·040	— ·003
June,	+ ·002	+ ·014	+ ·040	+ ·001	— ·001	+ ·004
July,	— ·028	+ ·011	+ ·004	— ·008	+ ·023	— ·014
August,	+ ·053	+ ·019	— ·016	+ ·004	— ·043	+ ·029
September,	+ ·017	+ ·021	— ·002	— ·015	— ·019	+ ·010
October,	+ ·040	+ ·021	+ 004	— ·007	— ·031	0
November,	+ ·021	+ ·011	+ ·006	+ ·010	— ·044	— ·004
December,	— ·063	— ·054	— ·001	+ ·002	— ·075	+ ·034

1871. *Table of total barometric Anomalies.*

	Port Blair.	Akyab.	Chittagong.	Madras.	Vizagapatam.	False Pt.
January,	— ·021	— ·044	— ·036	— ·014	+ ·004	0
February,	— ·010	— ·018	— ·029	— ·016	— ·011	— ·004
March,	?	+ ·009	+ ·013	+ ·013	+ ·012	+ ·011
April,	?	+ ·012	+ ·015	+ ·016	+ ·007	+ ·024
May,	?	— ·007	+ ·002	+ ·023	+ ·014	+ ·021
June,	+ ·030	— ·033	— ·026	— ·002	— ·031	— ·018
July,	+ ·016	— ·010	— ·015	+ ·005	— ·002	+ ·012
August,	+ ·022	— ·003	+ ·012	+ ·011	+ ·021	+ ·026
September,	+ ·001	— ·010	+ ·014	— ·007	— ·021	+ ·010
October,	+ ·001	— ·022	— ·015	+ ·015	+ ·015	+ ·016
November,	+ ·006	— ·007	— ·005	— ·011	— ·002	+ ·013
December,	+ ·023	+ ·026	+ ·035	+ ·018	+ ·008	+ ·046

	Cuttack.	Berhampore.	Monghyr.	Jubbulpore.	Nagpore.	Benares.
January,	— ·035	— ·033	— ·030	+ ·001	+ ·059	— ·018
February,	— ·028	— ·041	— ·038	— ·029	+ ·006	— ·030
March,	— ·003	— ·012	+ ·009	— ·005	+ ·028	— ·013
April,	— ·004	+ ·011	+ ·020	+ ·003	+ ·014	+ ·011
May,	— ·010	+ ·038	+ ·048	+ ·006	+ ·066	+ ·041
June,	— ·044	— ·011	— ·005	— ·046	— ·011	— ·008
July,	— ·011	— ·007	+ ·008	— ·016	+ ·026	+ ·010
August,	+ ·010	— ·011	+ ·018	— ·005	+ ·029	+ ·029
September,	— ·034	— ·022	— ·006	— ·060	— ·008	— ·030
October,	— ·031	— ·029	— ·022	+ ·023	+ ·017	— ·012
November,	— ·045	— ·042	— ·035	— ·032	— ·043	— ·021
December,	— ·014	+ ·015	+ ·021	— ·018	— ·013	+ ·016

1871. *Table of relative barometric Anomalies.*

	Akyab to Port Blair.	Akyab to Chittagong.	Vizagapatam to Madras.	False Pt. to Vizagapatam.	False Pt. to Cuttack.	False Pt. to Berhampore.
January,	— ·023	— ·008	+ ·018	— ·004	+ ·035	+ ·033
February,	— ·008	+ ·011	+ ·005	+ ·007	+ ·024	+ ·037
March,	?	— ·005	— ·001	— ·001	+ ·014	+ ·023
April,	?	— ·003	— ·009	+ ·017	+ ·028	+ ·013
May,	?	— ·009	— ·009	+ ·007	+ ·031	— ·017
June,	— ·063	— ·007	— ·029	+ ·013	+ ·026	— ·007
July,	— ·026	+ ·005	— ·007	+ ·014	+ ·023	+ ·019
August,	— ·025	— ·015	+ ·010	+ ·005	+ ·016	+ ·037
September,	— ·011	— ·024	— ·014	+ ·031	+ ·044	+ ·032
October,	— ·023	— ·006	0	+ ·001	+ ·047	+ ·045
November,	— ·013	— ·002	+ ·009	+ ·015	+ ·058	+ ·055
December,	+ ·003	— ·009	— ·010	+ ·038	+ ·060	+ ·031

1871. *Table of relative barometric Anomalies.*

	False Pt. to Akyab.	Cuttack to Jubbulpore.	Cuttack to Monghyr.	Berham- to Monghyr.	Berhampore to Chittagong.	Jubbulpore to Nagpore.	Jubbulpore to Benares.
January, ...	+ ·044	— ·036	— ·005	— ·003	+ ·003	— ·058	+ ·019
February, ...	+ ·014	+ ·001	+ ·010	— ·003	— ·012	— ·035	+ ·011
March, ...	+ ·002	+ ·002	— ·012	— ·021	— ·025	— ·033	+ ·008
April, ...	+ ·012	— ·007	— ·024	— ·009	— ·004	— ·011	— ·008
May, ...	+ ·028	— ·016	— ·058	— ·010	+ ·036	— ·060	— ·035
June, ...	+ ·015	+ ·002	— ·039	— ·006	+ ·015	— ·035	— ·038
July, ...	+ ·022	+ ·005	— ·019	— ·015	+ ·008	— ·042	— ·026
August, ...	+ ·029	+ ·015	— .008	— ·029	— ·023	— ·034	— ·034
September, ...	+ ·020	+ ·026	— .028	— ·016	— ·036	— ·052	— ·030
October, ...	+ ·038	— ·056	— .009	— ·007	— ·014	+ ·006	+ ·035
November, ...	+ ·020	— ·013	— .010	— ·007	— ·037	+ ·011	— ·011
December, ...	+ ·020	+ ·004	— .035	— ·006	— ·020	— ·005	— ·034

1872. *Table of total barometric Anomalies.*

	Port Blair.	Akyab.	Chittagong.	Madras.	Vizagapatam.	False Pt.	Cuttack.	Berhampore.
January, ...	+ ·028	+ ·014	+ ·027	+ ·013	+ ·035	+ ·015	— ·022	+ ·028
February, ...	+ ·011	+ ·020	+ ·033	+ ·008	+ ·016	— ·004	— ·013	+ ·029
March, ...	+ ·022	+ ·002	+ ·007	+ ·008	— ·005	— ·030	— ·026	— ·008
April, ...	— ·016	— ·023	— ·001	+ ·008	0	— ·011	— ·001	+ ·012
May, ...	— ·007	— ·019	+ ·002	— ·016	— ·006	— ·031	— ·011	+ ·015
June, ...	— ·019	— ·003	+ ·026	+ ·010	+ ·010	— ·041	— ·036	+ ·047
July, ...	— ·012	— ·008	+ ·025	+ ·005	+ ·013	— ·020	— ·018	+ ·033
August, ...	— ·026	— ·026	— ·005	— ·018	— ·030	— ·050	— ·040	— ·011
September, ...	— ·011	— ·011	+ ·040	+ ·006	+ ·016	+ ·023	+ ·020	+ ·039
October, ...	— ·024	— ·010	+ ·002	— ·008	— ·011	— ·019	— ·032	+ ·012
November, ...	— ·038	— ·045	— ·038	— ·039	— ·029	— ·041	— ·045	— ·016
December, ...	— ·024	— ·059	— ·046	— ·034	— ·041	— ·052	— ·065	— ·041

	Monghyr.	Jubbulpore.	Nagpore.	Benares.	Jhansi.	Agra.	Lucknow.
January, ...	+ ·027	+ ·006	— ·001	+ ·018	— ·015	+ ·017	+ ·014
February, ...	+ ·024	+ ·021	— ·003	+ ·018	— ·018	— ·004	+ ·027
March, ...	— ·008	+ ·006	+ ·007	— ·005	+ ·017	— ·012	+ ·005
April, ...	+ ·001	+ ·014	+ ·019	+ ·012	— ·001	— ·022	+ ·011
May, ...	+ ·002	— ·020	+ ·001	— ·001	+ ·011	— ·026	+ ·015
June, ...	+ ·024	+ ·009	+ ·010	+ ·020	+ ·033	— ·001	+ ·032
July, ...	+ ·022	+ ·001	+ ·010	+ ·012	+ ·036	+ ·001	+ ·030
August, ...	— ·016	— ·032	— ·038	— ·021	— ·016	— ·023	— ·024
September, ...	+ ·038	+ ·040	+ ·024	+ ·040	+ ·042	+ ·033	?
October, ...	+ ·008	+ ·018	+ ·001	+ ·006	— ·024	+ ·002	?
November, ...	— ·022	— ·019	— ·031	— ·017	— ·047	— ·039	?
December, ...	— ·035	— ·025	— ·048	— ·040	— ·038	— ·052	— ·054

1872. *Table of relative barometric Anomalies.*

	Akyab to Port Blair.	Akyab to Chittagong	Vizagapatam to Madras.	False Pt. to Vizagapatam	False Pt. to Cuttack.	False Pt. to Berhampore.	False Pt. to Akyab.	Cuttack to Jubbulpore.
January, ...	—·014	—·013	+ ·022	— ·020	+ ·037	— ·013	+ ·001	— ·028
February, ...	+ ·009	—·013	+ ·008	— ·020	+ ·009	— ·033	— ·024	— ·034
March, ...	—·020	—·005	— ·013	— ·025	—·004	— ·022	— ·032	— ·032
April, ...	—·007	—·022	— ·008	— ·011	—·010	— ·023	+ ·012	— ·015
May, ...	—·012	—·021	+ ·010	— ·025	—·020	— ·046	— ·012	+ ·009
June, ...	+ ·016	—·029	0	— ·051	—·005	— ·088	— ·038	— ·045
July, ...	+ ·004	—·033	+ ·008	— ·033	—·002	— ·053	— ·012	— ·019
August, ...	0	—·021	— ·012	— ·020	—·010	— ·039	— ·024	— ·008
September, ...	+ ·022	—·029	+ ·010	+ ·007	+ ·003	— ·016	+ ·012	— ·020
October, ...	+ ·014	—·012	— ·003	— ·008	+ ·013	— ·031	— ·009	— ·050
November, ...	—·007	—·007	+ ·010	— ·012	+ ·004	— ·025	+ ·004	— ·026
December, ...	—·035	—·013	— ·007	— ·011	+ ·013	— ·011	+ ·007	— ·040

	Cuttack to Berhampore.	Cuttack to Monghyr.	Berhampore to Monghyr.	Berhampore to Chittagong.	Jubbulpore to Nagpore.	Jubbulpore to Benares.
January, ...	— ·050	— ·049	+ ·001	+ ·001	+ ·007	— ·012
February, ...	— ·042	— ·037	+ ·005	— ·004	+ ·024	+ ·003
March, ...	— ·018	— ·018	0	— ·015	— ·001	+ ·011
April, ...	— ·013	— ·002	+ ·011	+ ·011	— ·005	+ ·002
May, ...	— ·026	— ·013	+ ·013	+ ·013	— ·021	— ·019
June, ...	— ·083	— ·060	+ ·023	+ ·021	— ·001	— ·011
July, ...	— ·051	— ·040	+ ·011	+ ·008	— ·009	— ·011
August, ...	— ·029	— ·024	+ ·005	— ·006	+ ·006	— ·011
September, ...	— ·019	— ·018	+ ·001	— ·001	+ ·016	0
October, ...	— ·044	— ·040	+ ·004	+ ·010	+ ·017	+ ·012
November, ...	— ·029	— ·023	+ ·006	+ ·012	+ ·012	— ·002
December, ...	— ·024	— ·030	+ ·006	+ ·005	+ ·023	+ ·015

	Jubbulpore to Jhansi.	Jubbulpore to Agra.	Lucknow to Agra.	Lucknow to Jhansi.
January, ...	+ ·021	— ·011	— 003	+ ·029
February, ...	+ ·039	+ ·025	+ 031	+ ·045
March, ...	— ·011	+ ·018	+ 017	— ·012
April, ...	+ ·015	+ ·036	+ 033	+ ·012
May, ...	— ·031	+ ·006	+ 041	+ ·004
June, ...	— ·024	+ ·010	+ 033	— ·001
July, ...	— ·035	0	+ 029	— ·006
August, ...	— ·016	— ·009	— 001	— ·006
September, ...	— ·002	+ ·007	?	?
October, ...	+ ·042	+ ·016	?	?
November, ...	+ ·028	+ ·020	?	?
December, ...	+ ·013	+ ·027	— ·002	— ·016

1873. *Table of total barometric Anomalies.*

	Port Blair.	Akyab.	Chitta-gong.	Mad-ras.	Vizaga-patam.	False Pt.	Cut-tack.	Berham-pore.
January, ...	— ·010	— ·051	— ·026	— ·005	— ·008	— ·052	— ·061	— ·045
February, ...	— ·019	— ·011	+ ·004	+ ·005	+ ·020	— ·004	— ·006	— ·004
March, ...	+ ·002	— ·002	+ ·032	+ ·016	+ ·020	— ·013	— ·004	+ ·011
April, ...	— ·005	— ·025	+ ·010	— ·018	— ·025	— ·045	— ·029	— ·016
May, ...	+ ·020	— ·015	+ ·035	+ ·037	+ ·053	+ ·009	+ ·021	+ ·041
June, ...	— ·030	— ·058	— ·023	— ·010	— ·035	— ·059	— ·066	— ·031
July, ...	— ·023	— ·063	— ·033	— ·003	— ·007	— ·073	— ·076	— ·054
August, ...	— ·003	+ ·014	+ ·056	+ ·008	+ ·021	— ·003	— ·005	+ ·038
September, ...	+ ·001	— ·018	+ ·020	+ ·024	+ ·008	— ·025	— ·040	— ·017
October, ...	— ·012	— ·005	+ ·028	— ·006	+ ·017	+ ·004	— ·021	+ ·018
November, ...	+ ·022	+ ·028	+ ·056	+ ·033	+ ·043	+ ·030	+ ·004	+ ·042
December, ...	+ ·031	0	+ ·016	+ ·005	— ·008	— ·009	— ·030	+ ·009

	Mon-ghyr.	Jubbul-pore.	Nagpore.	Benares.	Jhansi.	Agra.	Luck-now.
January, ...	— ·038	— ·007	— ·024	— ·049	— ·053	— ·068	— ·061
February, ...	0	+ ·005	— ·011	— ·001	+ ·005	— ·017	— ·011
March, ...	+ ·013	+ ·006	+ ·004	— ·012	+ ·012	— ·028	— ·011
April, ...	— ·030	— ·019	— ·006	— ·038	— ·021	— ·057	— ·056
May, ...	+ ·028	+ ·028	+ ·048	+ ·038	+ ·049	+ ·044	+ ·040
June, ...	— ·050	— ·034	— ·011	— ·053	— ·018	— ·059	— ·076
July, ...	— ·056	— ·026	— ·021	— ·049	— ·019	— ·047	— ·065
August, ...	+ ·029	+ ·024	+ ·010	?	+ ·035	+ ·023	+ ·009
September, ...	— ·021	0	+ ·009	?	— ·011	— ·015	— ·037
October, ...	+ ·011	+ ·033	+ ·027	?	+ ·026	+ ·017	+ ·012
November	+ ·035	+ ·040	+ ·022	?	+ ·043	+ ·033	+ ·028
December, ...	— ·008	+ ·022	+ ·002	?	+ ·005	— ·003	— ·011

1873. *Table of relative barometric Anomalies.*

	Akyab to Port Blair.	Akyab to Chitta-gong.	Vizaga-patam to Madras.	False Pt. to Viza-gapatam.	False Pt. to Cut-tack.	False Pt. to Ber-hampore.
January, ...	— ·041	— ·025	— 003	— ·044	+ ·009	— ·007
February, ...	+ ·008	— ·015	+ ·015	— ·024	+ ·002	0
March, ...	— ·004	— ·034	+ ·004	— ·033	— ·009	— ·024
April, ...	— ·020	— ·035	— ·007	— ·020	— ·016	— ·029
May, ...	— ·035	— ·050	— ·016	— ·044	— ·012	— ·032
June, ...	— ·028	— ·035	— ·025	— ·024	+ ·007	— ·028
July, ...	— ·040	— ·030	— ·004	— ·064	+ ·003	— ·019
August, ...	+ ·017	— ·042	+ ·013	— ·024	+ ·002	— ·041
September, ...	— ·019	— ·038	— ·016	— ·033	+ ·015	— ·008
October, ...	+ ·007	— ·033	+ ·023	— ·013	+ ·025	— ·014
November, ...	+ ·006	— ·028	+ ·010	— ·013	+ ·026	— ·012
December, ...	— ·031	— ·016	— ·013	— ·001	+ ·021	— ·018

1873. *Table of relative barometric Anomalies.*

	False Pt. to Akyab.	Cuttack to Jubbulpore.	Cuttack to Berhampore.	Cuttack to Monghyr.	Berhampore to Monghyr.	Berhampore to Chittagong.
January,	— ·001	— ·054	— ·016	— ·023	— ·007	— ·019
February,	+ ·007	— ·011	— ·002	— ·006	— ·004	— ·008
March,	— ·011	— ·010	— ·015	— ·017	— ·002	— ·021
April,	— ·020	— ·010	— ·013	+ ·001	+ ·014	— ·026
May,	+ ·024	— ·007	— ·020	— ·007	+ ·013	+ ·006
June,	— ·001	— ·032	— ·035	— ·016	+ ·019	— ·008
July,	— ·010	— ·050	— ·022	— ·020	+ ·002	— ·021
August,	— ·017	— ·029	— ·043	— ·034	+ ·009	— ·018
September,	— ·007	— ·040	— ·023	— ·019	+ ·004	— ·037
October,	+ ·009	— ·054	— ·039	— ·032	+ ·007	— ·010
November,	+ ·002	— ·036	— ·038	— ·031	+ ·007	— ·014
December,	— ·009	— ·052	— ·039	— ·022	+ ·017	— ·007

	Jubbulpore to Nagpore.	Jubbulpore to Benares.	Jubbulpore to Jhansi.	Jubbulpore to Agra.	Lucknow to Agra.	Lucknow to Jhansi.
January,	+ ·017	+ ·042	+ ·046	+ ·061	+ ·007	— ·008
February,	+ ·016	+ ·006	0	+ ·022	+ ·006	— ·016
March,	+ ·002	+ ·018	— ·006	+ ·034	+ ·017	— ·023
April,	— ·013	+ ·019	+ ·002	+ ·038	+ ·001	— ·035
May,	— ·020	— ·010	— ·021	+ ·016	— ·004	— ·009
June,	— ·023	+ ·019	— ·016	+ ·025	— ·017	— ·058
July,	— ·005	+ ·023	— ·007	+ ·021	— ·018	— ·046
August,	+ ·014	?	— ·011	+ ·001	— ·014	— ·026
September,	— ·009	?	+ ·011	+ ·015	— ·022	— ·026
October,	+ ·006	?	+ ·007	+ ·016	— ·005	— ·014
November,	+ ·018	?	— ·003	+ ·007	— ·005	— ·015
December,	+ ·020	?	+ ·017	+ ·025	— ·008	— ·016

1874. *Table of total barometric Anomalies.*

	Port Blair.	Akyab.	Chittagong.	Madras.	Vizagapatam.	False Pt.	Cuttack.	Berhampore.
January,	+ ·062	+ ·037	+ ·060	+ ·047	+ ·065	+ ·037	+ ·010	+ ·041
February,	+ ·013	+ ·030	+ ·055	+ ·016	+ ·029	+ ·011	— ·004	+ ·021
March,	— ·010	— ·016	+ ·022	— ·019	— ·004	— ·027	— ·028	— ·012
April,	+ ·025	+ ·023	+ ·052	+ ·030	+ ·024	— ·004	— ·003	+ ·015
May,	— ·002	— ·033	— ·004	— ·032	— ·014	— ·057	— ·049	— ·046
June,	+ ·002	+ ·014	+ ·055	+ ·022	+ ·011	+ ·001	— ·006	+ ·069
July,	— ·004	+ ·005	+ ·049	+ ·001	+ ·016	+ ·005	— ·008	+ ·069
August,	+ ·013	— ·009	+ ·010	+ ·008	— ·001	— ·032	— ·043	— ·005
September,	— ·008	+ ·007	+ ·035	— ·026	+ ·006	+ ·015	— ·014	+ ·017
October,	+ ·004	— ·015	— ·005	— ·022	— ·024	— ·041	— ·075	— ·026
November,	— ·018	+ ·007	+ ·015	+ ·011	+ ·005	— ·003	— ·027	+ ·022
December,	— ·040	+ ·002	+ ·026	+ ·016	+ ·027	+ ·021	— ·006	+ ·031

1874. *Table of total barometric Anomalies.*

	Mon-ghyr.	Jubbul-pore.	Nagpore.	Benares.	Jhansi.	Agra.	Luck-now.
January, ...	+ ·032	+ ·039	+ ·025	+ ·002	+ ·030	+ ·010	— ·001
February, ...	+ ·015	— ·015	— ·004	— ·009	— ·009	— ·008	— ·020
March, ...	— ·021	— ·028	+ ·007	— ·026	— ·020	— ·042	— ·055
April, ...	— ·005	— ·002	+ ·030	— ·022	+ ·016	— ·002	— ·014
May, ...	— ·080	?	— ·033	— ·094	— ·028	— ·056	— ·089
June, ...	+ ·036	+ ·040	+ ·023	+ ·020	+ ·032	+ ·023	+ ·021
July, ...	+ ·048	+ ·022	+ ·016	+ ·019	+ ·035	+ ·015	+ ·021
August, ...	— ·010	+ ·004	+ ·003	?	— ·008	— ·018	— ·022
September, ...	+ ·015	+ ·053	+ ·006	?	+ ·010	— ·012	— ·011
October, ...	— ·023	+ ·011	— ·018	?	— ·018	— ·043	— ·031
November, ...	+ ·024	+ ·039	+ ·025	?	+ ·016	— ·003	+ ·002
December, ...	+ ·023	+ ·058	+ ·032	?	?	+ ·003	— ·002

1874. *Table of relative barometric Anomalies.*

	Akyab to Port Blair.	Akyab to Chitta-gong.	Vizaga-patam to Madras.	False Pt. to Viza-gapatam.	False Pt. to Cut-tack.	False Pt. to Ber-hampore.
January, ...	— ·025	— ·023	+ ·018	— ·028	+ ·027	— ·004
February, ...	+ ·027	— ·025	+ ·013	— ·018	+ ·015	— ·010
March, ...	— ·006	— ·038	+ ·015	— ·023	+ ·001	— ·015
April, ...	— ·002	— ·029	— ·006	— ·028	— ·001	— ·019
May, ...	— ·031	— ·029	+ ·018	— ·043	— ·012	— ·011
June, ...	+ ·012	— ·041	— ·011	— ·010	+ ·007	— ·068
July, ...	+ ·009	— ·044	+ ·015	— ·011	+ ·013	— ·064
August, ...	— ·022	— ·019	— ·009	— ·031	+ ·011	— ·027
September, ...	+ ·015	— ·028	+ ·032	+ ·009	+ ·029	— ·002
October, ...	— ·019	— ·010	— ·002	— ·017	+ ·034	— ·015
November, ...	+ ·025	— ·008	— ·006	— ·008	+ ·024	— ·025
December, ...	+ ·042	— ·024	+ ·011	+ ·006	+ ·027	— ·010

	False Pt. to Akyab.	Cuttack to Jub-bulpore.	Cuttack to Ber-hampore.	Cuttack to Mon-ghyr.	Berham-pore to Mon-ghyr.	Berham-pore to Chitta-gong.
January, ...	0	— ·029	— ·031	— ·022	+ ·009	— ·019
February, ...	— ·019	+ ·011	— ·025	— ·019	+ ·006	— ·034
March, ...	— ·011	0	— ·016	— ·007	+ ·009	— ·033
April, ...	— ·027	— ·001	— ·018	+ ·002	+ ·020	— ·037
May, ...	— ·024	?	— ·003	+ ·031	+ ·034	— ·042
June, ...	— ·013	— ·046	— ·075	— ·042	+ ·033	+ ·014
July, ...	0	— ·030	— ·077	— ·056	+ ·021	+ ·020
August, ...	— ·023	— ·047	— ·038	— ·033	+ ·005	— ·015
September, ...	+ ·008	— ·068	— ·031	— ·029	+ ·002	— ·018
October, ...	— ·026	— ·086	— ·049	— ·052	— ·003	— ·021
November, ...	— ·010	— ·066	— ·049	— ·051	— ·002	+ ·007
December, ...	+ ·019	— ·064	— ·037	— ·029	+ ·008	+ ·005

1874. *Table of relative barometric Anomalies.*

	Jubbulpore to Nagpore.	Jubbulpore to Benares.	Jubbulpore to Jhansi.	Jubbulpore to Agra.	Lucknow to Agra.	Lucknow to Jhansi.
January,	+ ·014	+ ·037	+ ·009	+ ·029	— ·011	— ·031
February,	— ·011	— ·006	— ·006	— ·007	— ·012	— ·011
March,	— ·035	— ·002	— ·008	+ ·014	— ·013	— ·035
April,	— ·032	+ ·020	— ·018	0	— ·012	— ·030
May,	?	?	?	?	— ·033	— ·061
June,	+ ·017	+ ·020	+ ·008	+ ·017	— ·002	— ·011
July,	+ ·006	+ ·003	— ·013	+ ·007	+ ·006	— ·014
August,	+ ·001	?	+ ·012	+ ·022	— ·004	— ·014
September,	+ ·047	?	+ ·043	+ ·065	+ ·001	— ·021
October,	+ ·029	?	+ ·029	+ ·054	+ ·012	— ·013
November,	+ ·014	?	+ ·013	+ ·042	+ ·005	— ·014
December,	+ ·026	?	?	+ ·055	— ·005	?

IV.—*Description of a new Species of* Phasmidæ.—*By* James Wood-Mason.

(Recd. April 20th;—Read May 3rd, 1876.)

(With Plate XI).

Lonchodes verrucifer.

♂ ♀. Head armed between the middle of the eyes with two forwardly curved conical horns, connected by a slight transverse elevation, and with the hinder margin divided by notches into four or five tubercles. Antennæ long and setaceous. Mesosternum longitudinally carinate. The upper surface of thorax and abdomen traversed by a fine raised longitudinal line, sharper and finer in the female. The mesothorax moderately dilated at the insertion of the legs. Legs weak; all the femora have two minute spinules placed close together in the same straight line near the apex below, and the four posterior ones slightly widen from the proximal to the distal end, but neither pair is thickened; upper edge of the tibiæ and the first tarsal joint of fore-legs elevated into a sharp foliaceous crest, these parts being simple in the rest of the legs.

♂. Body quite smooth. The abdomen is uniform in width or tapers to an almost imperceptible extent from its base to the apex of the 6th segment; the 7th dorsal segment is dilated, the 8th, which is slightly swollen, narrowed, from base to apex, both are obtusely carinate; the strongly carinate basal half of the 9th is divided by a linear slit into two parts connected by

membrane only, its apical half forming the deflexed and slightly incurved arms of the forceps, which when closed are in contact at their tips only. Each arm of the forceps is furnished on its upper edge with about five short and stout dark brown incurved teeth, one of the teeth larger and more incurved than the rest being placed at the very extremity; and on the lower edge at the base with a very strongly toothed nearly semicircular process, the teeth of which interlock when the forceps is closed, and near the apex with one or two teeth. The terminal ventral segment forms a conoidal mass, the posterior slope of which is longitudinally carinate and the free end broadly rounded. The cerci anales are short, obtuse, depressed, and just perceptibly forcipated, being slightly but abruptly incurved at the very tips.

♀. Body entirely covered with granules, which are very much less distinct on the seven posterior segments of the abdomen. Mesothorax considerably dilated at the insertion of the legs. The abdomen tapers slightly from base to apex of first segment, then widens slightly to the end of the 5th, which is marked above on its expanded posterior half with a low, rough, wart-like excrescence; the 7th is depressed and provided below at the middle of its hinder margin with a very short broadly rounded process, from which a limp acuminate process projects straight backwards; three terminal dorsal segments narrower, tapering slightly to their apex, the last scarcely emarginate and carrying a longitudinally carinate semioval plate at its extremity; all the segments, especially the three last, with a small tubercle at the middle of the hinder border of their dorsal arcs. Operculum sub-spatulate in outline as seen from below, with a moderately well-developed carina about the middle of its posterior half. The foliaceous crest of the fore-tibiæ is expanded into a plaited lobe at the end of its proximal half. The minute cerci are covered by the slightly produced postero-lateral angles of the last segment.

♂. Total length, 3 in. 7 lin.; head, $1\frac{1}{2}$; proth., $1\frac{1}{2}$; mesoth., $11\frac{1}{4}$; metath., $6\frac{1}{2}$; abd., $18 + 4\frac{1}{4} = 22\frac{1}{4}$; antenn., $27\frac{1}{2}$ lines.

♀. Total length, 4 in. $8\frac{1}{2}$ lin.; head, $2\frac{1}{2}$; proth., $2\frac{1}{2}$; mesoth., $14\frac{1}{2}$; metath., 9; abd., $23\frac{1}{4} + 4\frac{3}{4} = 28$; antenn., $23\frac{1}{4}$ lines.

Hab.—Two males and a single female were captured on South Andaman by my native collector in 1872; and an immature example of the latter sex was presented to me by Mr. E. H. Man, during my visit to these islands in the same year.

This species forms—with *Lonchodes amaurops*, Westw., *nodosus*, DeHaan, *brevipes*, G. R. Gray, *uniformis*, Westw., *Crawangensis*,* DeHaan,

* The whole structure of the two insects is opposed to the supposition that the *Phasma nematodes* is the male of the *P. Crawangense* of DeHaan: an insect with comparatively-short and filiform antennæ, with the first joint of its fore tarsi long and simple, and with minute conical cephalic horns, can hardly be the male of one in which the

bifoliatus, DeHaan, etc.—a little group all the members of which are distinguished, amongst other things, by having the tibiæ and the first tarsal joint of the fore-legs raised into sharp foliaceous crests. This section of the genus is represented in India by *L. brevipes*, which is said to be a native of the Malabar coast, the fauna of which is well-known to be largely leavened with Malay forms.

EXPLANATION OF PLATE XI.

Fig. 1. The male, of the natural size. 2. The three terminal segments of the abdomen, seen from the side, × 2. 3. Do., from below, × 3. 4. The terminal segment, from below, greatly enlarged so as to show the structure of the forceps. 5. The female, of the natural size. 6. The five terminal segments of the abdomen, seen from the side, of the natural size.

V.—*Description of* Felis Shawiana, *a new Lyncine Cat from Eastern Turkestan.—By* W. T. Blanford, *F. R. S., &c.*

(Received June 2nd;—Read June 7th, 1876.)

Amongst the collections made by the late Dr. Stoliczka in Eastern Turkestan, was an imperfect skin of a cat. Although I thought it probable that it belonged to an undescribed form, there was a bare possibility that it might be a specimen of a species inhabiting Western Turkestan and described by Dr. J. E. Gray in 1873* as *Chaus caudatus*. The tail was certainly much shorter than was represented in Dr. Gray's figure, but this might have been due in part at least to a portion having been lost. Accordingly, in the list of the collections published in last year's Journal,† I noted the species as *Felis* sp. near *F. pardina* (? *Chaus caudatus*, Gray).

Recently two additional skins of the same cat have been brought from Yárkand, one by Mr. Shaw and the other by Dr. Scully. Both have been entrusted to me for examination and description. Neither is perfect, but Mr. Shaw's specimen only wants the paws, and the whole skeleton has been preserved with the skin. It is evident that the species is quite distinct from *Chaus caudatus*, the tail being considerably shorter and the skull of quite a different form. I propose to name this interesting species after

antennæ are long and setaceous and much longer than those of its supposed partner, in which the first joint of the fore tarsi is sharply crested, and in which the head is armed with foliaceous horns; but it will, I feel confident, prove to be the opposite sex of an insect closely allied to *Lonchodes* (olim *Bacillus*) *cuniculus* (conf. P. A. S. B., 1873, p. 149; and A. and M. N. H., 4th. Ser., 1873, Vol. XII, p. 348). A fine specimen of *L. Crawangensis*, ♀, has been sent by my native collector from Johore, in the Malay peninsula.

* P. Z. S. 1874, p. 31. Pl. VI, VII.

† J. A. S. B., 1875, XLIV. Pt. 2, p. 106.

Mr. Shaw, to whom we are so largely indebted for our knowledge of Yárkand and Káshghar.

Felis Shawiana, sp. nov.

Felis F. domesticam *magnitudine superans, ad* F. chaus *proxime accedens ; griseo-fulva, nigro-maculata, subtus alba atque maculis nigris majoribus ornata ; caudâ breviusculâ, supra, apicem versus, nec infra, nigro-transfasciatâ ; cranio elongato, ei* F. viverrinæ *simili ; vellere molli, basin versus pallide purpurascenti-griseo : longitudine* (sc. *pellis*) *sine caudâ bipedali, caudæ* 7—8 *unc., cranii* 4.25.

Hab.—Eastern Turkestan, in the plains around Yárkand and Káshghar.

Description.—General colour pale greyish fulvous above, the back rather darker than the sides, underparts white ; the body marked throughout with rather small black spots, which are largest on the abdomen, smaller and closer together on the shoulders and thighs, tending to form cross lines on the latter, and indistinct on the middle of the back ; anterior portion of the face and muzzle whitish, cheek stripes of rusty red and black hairs mixed. Ears rather more rufous outside, especially towards the tip, which is blackish brown, and pointed, the hairs at the end scarcely lengthened, interior of ears white. There are some faint rufous spots at the side of the neck. Breast very faintly rufous with one narrow brownish band across. Inner side of limbs mostly white, a black band inside the forearm, and a very black spot behind the tarsus. Apparently there are two black bands inside the thigh, but the limbs are ill preserved in all the specimens. Tail dusky above near the base, with 5 or 6 black bars above on the posterior half, none below, the dark bars closer together towards the tip. Fur soft, moderately long, purplish grey towards the base.

The size appears rather to exceed that of a domestic cat, and to equal that of the *Chaus.* The tail apparently is about half the length of the body without the head. In the two best skins examined the length from nose to rump is about 25 inches, the tails 7 to 8, but very little dependence can be placed on such measurements. The tail-vertebræ from the posterior end of the sacrum measure when put together 8·75 inches, which would coincide with a tail measurement outside the body of about $7\frac{1}{2}$ inches.

The skeleton is that of an adult animal and the following are dimensions of the skull and limb bones :

	Metre	Inches
Total length of skull,................................	·108	4·25
Length from incisors to lower edge of foramen magnum,..	·093	3·67
Breadth across hinder parts of zygomatic arches,	·073	2·87
„ behind postorbital processes, ...	·031	1·23
Least breadth of face between orbits, ...	·020	0·8

	Metre	Inches
Length of suture between nasal bones, ...	·025	1·
Greatest diameter of bony orbit, ...	·032	1·25
Length of bony palate behind incisors, ...	·041	1·63
Length of mandible, ...	·073	2·88
Height of do. from the angle to the top of the coronoid process, ...	·033	1·3
Length of femur, ...	·140	5·52
„ of tibia, ...	·141	5·57
„ of humerus, ...	·126	4·95
„ of radius, ...	·133	5·26

Compared with the skull of *Felis chaus*, that of *F. Shawiana* is comparatively longer, it has the nasal portion more elongate, the face less convex, the breadth behind the postorbital processes less, whilst the processes themselves are longer and project farther. The true lynxes have an even shorter and more convex skull and so have the smaller typical cats. The skull of *Chaus caudatus* approximates to that of the true cats, being rounder and shorter than that of *F. Chaus*. The only skull I can find which approaches in form to that of *Felis Shawiana* belongs to *F. viverrina*, the type of Gray's genus *Viverriceps*, a cat with a peculiarly long head.

Felis Shawiana is distinguished externally from *F.* (*Chaus*) *caudata* by its much shorter tail, from *F. Chaus* by being spotted throughout, and from *F. torquata* (*F. ornata*, Gray) by its shorter tail, more rufous colouration, and distinct black spots on the abdomen. It is very different from *F. euptilura*,* which has red spots on the sides and rufous bars across the breast.

* Elliot, P. Z. S., 1871, p. 758, Pl. LXXVI.

VI.—*Description of a new species of* Cetoniidæ.—*By* James Wood-Mason.

(Read Jan. 5th, 1876.)

Sub-fam. *GOLIATHINÆ.*

Heterorhina Roepstorffii.

P. A. S. B., 1876, p. 4.

Tota nigra, nitida; clypeo ut in H. Childrenii; *elytris singulis macula parva subquadrata vel subovata alba.*

Long. tota maris unic., 15 *mm.*; *fœm.* 15½ *mm.*

Wholly black, shining, somewhat attenuated; clypeus as in *H. Childrenii;* a small subquadrate or subovate spot—dirty straw-coloured in the dead but brilliant white in the living insect—occupies about the second fourth of the length and the external or anterior two-thirds of the breadth of each elytron. The fore tibiæ are subbidentate in the female, and the abdomen of the male is longitudinally channeled below.

The species belongs to the same little group as *HH. bimacula*, *confusa*, *Cuvera*, and *Childrenii*, from all of which it differs in being wholly black, no part of its body being coloured blood-red as in those species, in its slenderer and more attenuated form, and in the smaller size of the patches on the elytra; but it agrees with the last-named in the structure of the clypeus and in the form of the mesosternal process.

In slenderness of body, *H. Roepstorffii* somewhat approaches *H. modesta*, Wallace—a species belonging to a different section of the genus.

Hab.—South Andaman, where it was collected by Mr. F. A. de Roepstorff.

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VII.—*An Account of Experiments made in* 1875 *and* 1876 *in various parts of India, for the purpose of comparing the observed Temperature of the Dew-point with that computed from the Psychrometer by different Methods of Reduction.—By* HENRY F. BLANFORD, *F. G. S., Meteorological Reporter to the Government of India.*

(Received May 29th ;—Read June 7th, 1876.)

The observations of which the results are detailed and discussed in this paper, were made with the special object of ascertaining how far the usual methods of computing the hygrometric state of the atmosphere from observations of the dry and wet bulbs thermometers, under the conditions* now adopted at Indian meteorological observatories, afford trustworthy results; more especially in the extremely dry atmosphere of the interior of India during the hot season. The observations are to a certain extent desultory, having been made during inspection tours in different parts of India, and under various conditions of exposure; and the results shew some discrepancies, greater than might be expected from more systematic work, and had there been means at hand to introduce such improvements in the manipulation of the hygrometer as experience has suggested. Causes of disturbance, which would produce but little effect in a more humid atmosphere, become influential when the dew point is 40° and

* The thermometers are exposed on a frame with 1 or 2 cross bars (generally protected by wire netting at back and front) under a thatched shed open on all sides to the wind. Where properly constructed the shed is 20 ft. long by 12 ft. wide, but some are smaller than this.

more below the temperature of the air, and observations made at a distance from all the convenient appliances of a physical laboratory, in hot winds and under the intense glare of an Indian sun, are not easily endowed with that precision which is desirable and which is easily to be attained in a well fitted observatory of a high class. I can only say that I have endeavoured to take all such precautions as were practicable and if the range of individual error is on the whole considerable, I believe that the mean result affords a trustworthy criterion of the comparative value of the psychrometric methods; and that, with proper precautions, very trustworthy data of the hygrometric state of the atmosphere may be obtained with the dry and wet bulb thermometers, at all events when the humidity does not fall below 20 per cent. of saturation. Greater degrees of dryness I have as yet had no opportunity of testing; though such are prevalent somewhat later in the season than when my observations were made; especially in Sind and the Punjab, and on the plateau of Central India.

The earlier series of observations were made during an inspection tour in the Madras Presidency, in April 1875. I regret that the original rough record has been mislaid, and I am able to give only the means of each set of readings. In these series (Nos. 1 to 13 of the Tables), the means adopted for the readings of the Regnault's hygrometer include the temperatures at which the dew disappeared from the silver capsule of the instrument, which is not the case with the later series. In striking the adopted mean of each set of readings, the mean temperature at which dew was deposited and that at which it disappeared were taken separately, and the mean of the two results adopted as the dew-point. The difference, however, rarely amounted to a degree, and is very small in comparison with the difference of the temperature and that of the dew-point.

The later series were made during a recent tour in Upper India, in the months of March and April. The air temperatures are generally lower than the Madras series, but the dew-points are proportionally lower. They indicate a very dry atmosphere, although not so low a relative humidity as is shewn later in the season by the registers of many stations in the interior.

The same hygrometer has been used throughout. It is one of Casella's manufacture, and is of the form represented in his illustrated catalogue; it has a single capsule, the air-thermometer being freely exposed; and the evaporation of the ether is accelerated by blowing from the mouth through a piece of elastic tubing about 15 inches in length. Both the thermometers have been verified by myself; at the freezing point by immersion in crushed ice; and through the range of observation, by comparison with a Kew standard (No. 374) which I received in 1868 from Prof. Balfour Stewart.

At the Madras stations (excepting Trichinopoly and Madras), the psychrometric observations were made with the observatory thermometers

(with small pea-bulbs) which Mr. Pogson had verified by comparison with a Kew standard in his possession.

The Upper Indian series (16 to 21) of psychrometric observations were made with a pair of Casella's thermometers of the Kew pattern (with small spherical bulbs) mounted, 6 inches apart, on a portable wooden stand, in such manner that the free access of air is unimpeded in all directions. Both thermometers have been compared in water with my Kew standard and have also been verified at the freezing point. The wet bulb was covered with a single thickness of old thin calico; the water bottle was placed 2 inches to the side of the bulb, with the water level $\frac{1}{4}$ inch below it, and communication was made by a well-washed lamp-wick of some dozen threads of coarse yarn. Care was taken that the bulb was at all times well moistened.

The psychrometer observations at Trichinopoly, Madras, and Calcutta were taken with a sling thermometer, *viz.* that of the hygrometer, in the intervals of the dew-point observations.

In most cases the readings of the instruments were made by two observers, one of whom (myself) read off the Regnault, and the other the psychrometer, on the dew-point signal being given by the first observer. In very dry states of the atmosphere, the mercury of both the dry and wet bulbs is in a state of constant oscillation, through a range of a degree or more; moreover, unless the silver capsule is very highly burnished and free from microscopic scratches, there is considerable difficulty in seizing the exact temperature at which dew appears, since the quantity deposited is very small and but slightly dulls the surface even at 3 or 4° below the dew-point. The surface of the capsule having been polished with plate-powder, was not in the best condition, and it is likely that some of the discrepancies to be noticed in the tables may have been in some measure due to this; but I do not think that the error thus arising could exceed a few tenths of a degree, as great watchfulness was exerted, and any observation that appeared doubtful at the time was rejected. I shall in the sequel suggest some precautions and improvements which may be useful to future observers.

In the following Tables, the dew-point determined directly by the hygrometer is compared with that computed from simultaneous observations of the psychrometer by each of the three methods in common use. The first is August's formula as corrected by Regnault and adapted to English standards. It is given at page 47 of Guyot's Hygrometric Tables, for wet-bulb temperatures above the freezing point as follows:

$$x = f - \frac{0{\cdot}480 \times \frac{5}{9}\,(t-t')}{610 - \frac{5}{9}\,(t'-32)}\,h = f - \frac{0{\cdot}480\,(t-t')}{1130-t'}\,h$$

wherein x is the tension of saturated vapour at the temperature of the dew-

point, f the same at the temperature t' of the wet bulb, t the air temperature and h the barometer reading.

The development of this formula may be found in Regnault's original paper, published in the *Comptes rendus* for April 1845, or in the translation given in the 3rd Volume of Taylor's Scientific Memoirs. Also in the article 'Hygrometry' in Watts's Chemical dictionary. It is based on the assumption that the film of air around the wet bulb is saturated with vapour, and that the heat lost by this film of air, in falling to the temperature of the wet bulb, is exactly equal to the latent heat absorbed by the water which passes into vapour in the act of bringing it to saturation.

The second is Apjohn's well-known formula, given in almost all English manuals of physics and meteorology, as follows, for temperatures of t' above the freezing point:

$$x = f - \frac{t - t'}{88} \cdot \frac{h}{30}$$

The development of this formula was given by Dr. Apjohn in the Transactions of the Royal Irish Academy, November 1834, and is reproduced in Professor Everett's translation of Deschanel's Natural Philosophy. It proceeds on precisely the same assumption as the previous formula, but assumes a mean constant instead of a variable value for the latent heat of vapour, by which the formula is somewhat simplified; the difference of the results afforded by Apjohn's and August's formula depends, however, mainly on the different values assumed for the constant coefficients common to the two formulæ.

In applying these formulæ, I have taken the vapour-tensions from a table lately computed for the mean latitude of 22°, from that given by the Rev. Robert Dixon for the latitude of Dublin.

Glaisher's factors, with which the third values of the dew-point are obtained, are those published in 1856. Their use is of course open to the objection that they take no account of variations of barometric pressure. As a rule they seem to give a result too low with a high relative humidity and too high with low humidities.

TABLE I. A.—*Abstract of observations made in 1875, chiefly in the Madras Presidency.*

Place.	Date.	Hour.	Series.	Regnault's Hygrometer.			Mason's Hygrometer.				Red Bar.	Computed D. P.			Remarks.
				No. of obs.	Air.	D. P.	No. of obs.	Dry.	Wet	Diff.		Aug.	Apj.	Glaish.	
		h. m.													
Secunderabad. In thermometer shed of observatory.	April 6th, 1875.	12 40 to 12 50	1	6	92·3	47·6	2	92·4	67·9	24·5	28·07	50·1	53·7	53·0	Air in thermometer shed almost motionless. Anemometer on rock, 4 miles per hour. Wind N by E. to ENE. Cloud 5.
		13 5	2	1	93·5	52·5	1	93·4	70·1	23·3		55·8	58·4	55·9	
		13 8 to 13 10	3	6	94·5	50·5	4	94·8	70·6	24·2		55·4	58·5	56·1	
		13 25 to 13 31	4	12	92·8	50·9	3	92·7	69·6	23·1		54·8	57·9	55·5	
Bellary. In thermometer shed of observatory.	April 9th.	9 24 to 9 29	5	7	94·9	54·2	4	94·0	69·7	24·3	28·40	53·8	57·0	55·1	Wind blowing gently through thermometer shed. SE to SW. Anemometer on building 10 miles per hour. Light cirri.
		9 26	6	2	95·1	58·1?	1	94·7	68·9	25·8		51·1	54.8	53·4	
		9 30 to 9 35	7	8	95·4	51·7	4	94·7	68·4	26·3		49·7	53.6	52·6	
		9 50 to 10 0	8	9	96·1	47·8	4	95·8	66·6	29·2		43·2	48.4	49·4	

TABLE I. A.—*Continued.*

PLACE.	Date.	Hour.	Series.	Regnault's Hygrometer. No. of obs.	Regnault's Hygrometer. Air.	Regnault's Hygrometer. D. P.	Mason's Hygrometer. No. of obs.	Mason's Hygrometer. Dry.	Mason's Hygrometer. Wet	Mason's Hygrometer. Diff.	Red Bar.	Computed D. P. Aug.	Computed D. P. Apj.	Computed D. P. Glaish.	REMARKS.
		h. m.													
Coimbatoor. In thermometer shed of observatory.	April 16th.	15 33 to 15 54	9	8	96·7	48·6	5	96·8	68·9	27·9	28·39	49·1	53·2	52·4	Anemometer, on shed, 5 miles an hour. Breeze occasionally felt in shed. Wind E. Fanning wet bulb produced no reduction.
		15 50	10	1	96·1	46·5	1	96.4	68·5	27·9		48·4	52·6	52·0	
		16 35 to 16 50	11	10	95·7	52·8	5	95·3	69·9	25·4		53·1	56·6	54·7	
Trichinopoly. In verandah on 1st floor.	April 21st	17 25 to 17 45	12	6	89·6	71·0	3	89.6	77·2	12·4	29·35	71·7	72·7	69·4	Wet B. temperature taken with D. P. thermometer of Regnault with wet muslin on bulb used as *thermométre fronde.*
Madras. In verandah of upper storey.	April 25th.	11 40 to 12 3	13	5	97·2	61·1	3	97·0	74·1	22·9	29·72	60·8	63·4	60·6	As the previous series.
Calcutta. In ground-floor room, windows open 2 sides.	June 18th.	11 15 to 11 22	14	9	84·8	77·8	2	84·2	79·4	4·8	29·60	77·4	77·7	76·2	As the previous series.
Calcutta, as above.	June 19th.	9 30 to 9 45	15	12	83·8	77·5	2	83·8	79·7	4·1	29·55	78·0	78·3	77·0	As the previous series.

TABLE I. B.—*Observations made in 1876 in Upper India.*

Place.	Date.	Hour.	Ser.	Regnault's Hygrometer. Obs. Air.	Obs. D.P.	Mean Air.	Mean D. P.	Mason's Hygrometer. Obs. Dry.	Obs. Wet	Mean Dry.	Mean Wet.	Diff.	Red Bar.	Computed D. P. Aug.	Apj.	Glaish.	Remarks.
Allahabad in West verandah of Mr. Elliott's house.	March 16th, 1876.	7 h.	16	77·2	47	77·2	47	77·4	61·2	77·4	61·2	16·2	29·54	47·2	50	49·9	Very open, no chiks: fresh breeze from West.
		15 h.	17	87·1 87·2 87·1 87·1 87·3	46 46·5 45·3 45 45·5	87·1	45·7	87·1 87·3 87·3 87·3 87·3	65·5 65·2 65 65 65·5	87·3	65·2	22·1	29·45	47·5	51·1	51·1	Wind perceptible in verandah; from W.
Agra in West verandah of the dâk bungalow.	March 18th.	Noon.	18	85·2 85·2 85·4 85·4 85·9 86·6 86·7	38·4 40 40·1 42 42·5 41·7 40	85·8	40·7	85·6 85·6 85·7 85·8 86·2 86·9 87	60·4 60·6 60·5 60·6 61·1 61·6 60·6	86·1	60·8	25·3	29·35	34·6	40·5	44·4	Light wind from West; chiks up. Cloud cirro-stratus 5.
Lahore in West verandah of Dr. Neil's house.	March 26th.	14 h.	19	81·9 82·8 82·8 82·7 82·7 82·9 83·1 82·8	40 41·1 39·9 39·4 39·4 40·4 39·2 39·4	82·7	39·8	82 82·7 82·9 82·9 82·9 83·4 83·4 83·1	61·8 62·7 62·4 62 62·1 62·6 62·6 62	82·9	62·3	20·6	29·08	44·4	48·0	48·5	Chiks down; wind from W. scarcely felt in verandah. Cloud cirro-stratus 8.

TABLE I. B.—*Continued.*

Place.	Date.	Hour.	Ser.	Regnault's Hygrometer.				Mason's Hygrometer.					Red Bar.	Computed D. P			Remarks.
				Obs. Air.	Obs. D.P.	Mean Air.	Mean D. P.	Obs. Dry.	Obs. Wet	Mean Dry.	Mean Wet.	Diff.		Aug.	Apj.	Glaish.	
		h. m.															
Lahore in thermometer-shed. Mayo College.	April 4th, 1876.	9 15	20	72·9	37·5			72·8	55·3								
				73	37·5			72·8	55·8								
				73	38·3			72·9	55·3								
				73·3	37·7	73·2	37·8	72·8	55·8	73	55·6	18·4	29·18	34·9	39·2	41	A light breeze from the West blowing through the shed.
				73·3	37·4			72·9	55·8								
				73·5	37·6			73·3	55·8								
				73·3	37·8			73·3	55·3								
				73·2	37·3			73	55·6								
		9 35	21	74·6	36·6			74·9	56·8								
				74·8	36·5			74·9	56·8								
				74·8	38			74·9	56·9								
				74·8	37·5	74·8	37·2	75	57	74·9	56·9	18·0	29·18	38	41·8	43·9	Ditto.
				74·8	37·6			74·9	57								
				74·8	37·3			74·9	56·8								
				74·8	37·1			74·9	56·8								

Assuming the direct dew-point determinations to be correct, the following are the errors shewn by the several computations.

TABLE II.—*Errors of Dew-points computed from Psychrometer by different methods.*

PLACE.	Series.	D. P. below air.	ERRORS. Aug.	Apj.	Glaish.	CONDITIONS.
Secunderabad, ..	1	44·7	+ 2·5	+ 6·1	+ 5·4	In thermometer-shed.
Do. ..	2	41·0	+ 3·3	+ 5·9	+ 3·4	
Do. ..	3	44·0	+ 4·9	+ 8·0	+ 5·6	
Do. ..	4	41·9	+ 3·9	+ 7·0	+ 4·6	
Bellary, ..	5	40·7	— 0·4	+ 2·8	+ 0·9	Do.
Do. ..	6	? 37·0	?— 7·0	?— 3·3	?— 4·7	
Do. ..	7	43·7	— 2·0	+ 1·9	+ 0·9	
Do. ..	8	48·3	— 4·6	+ 0·6	+ 1·6	
Combatoor, ..	9	48·1	+ 0·5	+ 4·6	+ 3·8	Do.
Do. ..	10	49·6	+ 1·9	+ 6·1	+ 5·5	
Do. ..	11	42·9	+ 0·3	+ 3·8	+ 1·9	
Trichinopoly, ..	12	18·5	+ 0·7	+ 1·7	— 1·6	In verandah. Sling-thermometers.
Madras, ..	13	31·1	— 0·3	+ 2·3	— 0·5	Do. Do.
Calcutta, ..	14	13·0	— 0·4	— 0·1	— 1·6	In sitting room. Do.
Do. ..	15	6·3	+ 0·5	+ 0·8	— 0·5	
Allahabad, ..	16	29·3	+ 0·2	+ 3·0	+ 2·9	In verandah.
Do. ..	17	41·4	+ 1·8	+ 5·4	+ 5·4	
Agra, ..	18	45·1	— 6·1	— 0·2	+ 3·7	Do.
Lahore, ..	19	42·9	+ 4·6	+ 8·2	+ 8·7	Do.
Do. ..	20	35·4	— 2·9	+ 1·4	+ 3·2	In thermometer-shed.
Do. ..	21	37·6	+ 0·8	+ 4·6	+ 6·7	
Mean,* ..	..	..	+ 0·46	+ 3·70	+ 3·00	

In most of the above series the computed is higher than the observed dew-point, especially when the computation is made by Apjohn's formula. The exceptions are series 6 at Bellary (in which, however, I think the dew-point observation is open to considerable doubt†) and series 14 at Calcutta and 18 at Agra, in which the computed values are too low.

The following table exhibits the mean results of the table of errors, *viz.*, the numbers of sets of observations which give excessive or deficient dew-point temperatures, the mean error, the extreme errors and the sums of the squares of the errors, positive and negative, by each method of reduction.

* Omitting series 6.

† It is not unlikely that there has been some error in the determination of the dew-point by the direct method, which, it may be observed, is derived from 2 observations only (one of deposition and one of disappearance). These observations were taken in among the 7 of the preceding series, and I have separated them on account of their discrepancy. I have not, however, felt justified in rejecting them, since I have no knowledge of any cause of error affecting them which might not have affected others.

TABLE III.

Method.	Sets obs. in excess.	Sets obs. in defect.	Mean Error.	Highest. +	Lowest. —	Sums of squares of errors. +	Sums of squares of errors. —
By August's form.,	13	7	+ 0·46	4·9	6·1	86·13	71·19
„ Apjohn's „	18	2	+ 3·70	8·0	0·2	406·98	0·05
„ Glaisher's facs.	16	4	+ 3·00	8·7	1·6	327·80	5·62

If we take those series only that were made in the thermometer-sheds, with a mean difference of 42·7° (extremes 35·4 and 49·6) between the air-temperature and the dew-point, the errors of the several methods are as follow:

TABLE IV.

Method.	Series. in excess.	Series. in def.	Mean Error.	Highest. +	Lowest. —	Sums of squares of errors. +	Sums of squares of errors. —
By August's form.,	8	4	+ 0·68	4·9	4·6	60·95	33·73
„ Apjohn's „	12	0	+ 4·40	8·0	—	292·76	—
„ Glaisher's facs.,	12	0	+ 3·62	6·7	—	200·85	—

The first general conclusion to be drawn from this discussion is that while the results shew a considerable range of error (which may be in part due to a faulty use of the Regnault), on the mean of all the observations, the dew-point computed by August's formula from observations of the psychrometer made under an open shed, comes very near to that observed with Regnault's hygrometer, even when the dew-point is more than 40° below the temperature of the air. Both Apjohn's formula and Glaisher's factors appear to give too high a result.

With regard to the less complete exposure afforded by a verandah, or any place through which the air is not moving freely, the two Allahabad series (16 and 17) and the first Lahore series (19) shew that the psychrometer, in such a situation, gives too high a humidity by all the methods of reduction; and the Secunderabad series (1 to 4) though made under a shed, tend to support the conclusion that a still atmosphere is prejudicial to all the psychrometric method. These observations were taken on the day of

the solar eclipse; the sky was cloudy; and in the shed, the air was appreciably motionless. The shed was screened from such little wind as stirred the anemometer, partly by a neighbouring building, and partly by rising ground. Even on the top of a neighbouring rock, on which the anemometer was fixed on a post, there was sufficient air only to stir the vanes at intervals, and in the shed the atmosphere was still and oppressive. Hence it would appear that under all conditions a still atmosphere is unfavourable to the accuracy of the psychrometric method. This conclusion has already been drawn by previous observers.

These conclusions must nevertheless be regarded as provisional only, until similar experiments shall have been made with more consistent results.

I have said that the experience now gained has shewn the necessity for some additional precautions and improvements in the use of the Regnault's hygrometer in a very dry atmosphere; and I will mention these, in the hope that other observers may be induced to pursue the investigation. These are—

1*st.*—The silver capsule must be highly burnished and free from microscopic scratches, which so reflect the light as to make it very difficult to seize the moment of dew-deposition. This surface can be given only by hand-polishing with the softest part of the skin (care being taken that the skin is free from grit) and with the application of a little carefully kept jeweller's rouge. Plate powder, wash leather, and soft rag are equally to be avoided; and when once polished, great care must be taken to preserve the instrument from grit and dust. The Indian rubber tube which communicates with the air pipe, must be kept apart from the instrument when not in use, or the sulphur evaporating from it will quickly blacken the surface.

2*nd.*—The mouth tube of Casella's instruments should be replaced by a finger bellows or some other portable form of blower which can be worked rapidly but is under complete control; or else the instrument should be adapted for the use of an aspirator.

3*rd.*—A black screen should be so placed at the side of the instrument that its reflection may be thrown from one side of the silver capsule to the eye.

4*th.*—In experimenting in the open air, great care must be taken not to sit to windward of the hygrometer and not to approach it nearer than is absolutely necessary to take the reading. The mouth and nose should be covered with a handkerchief during the experiment to prevent any breath reaching the instrument.

5*th.*—In very dry states of the atmosphere it is best to take a preliminary observation in which the blowing is continued until a decided and comparatively copious deposit is formed, noting as nearly as possible the temperature at which it first appears. This observation is made for guid-

ance only. In the subsequent observations, by regulating the flow of air, the temperature is to be lowered very gradually as it approaches the point noted; and on the first appearance of dullness, the blast is arrested, but the reading of the thermometer is not to be taken till it reaches its lowest point.

There are other points to be attended to, which unpractised observers frequently neglect. One is to keep the eye on the same level as the top of the mercurial column of the thermometer (whether that of the hygrometer or psychrometer) when taking the reading, in order to avoid the errors of parallax. This is a point which it is most difficult to enforce on those who are not thoroughly trained observers, and such persons are few in India.

The capsule must not be more than three parts filled with ether, and at first a very gentle blast must be applied or the ether will spill over the surface of the capsule; and if not perfectly pure, will impair its polish. The ether must be free from water.

VIII.—*List of the Birds collected on the Expedition into the Dafla Hills, Assam, together with those obtained in the adjacent Darrang Terai.—By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., &c., Deputy Supt. Topographical Survey of India.*

(Received May 26th;—Read June 7th 1876).

(With Plates III & IV.)

Having been placed in charge of the survey-party attached to the force which, under the command of Brigadier-General W. J. F. Stafford, C. B., penetrated into the Dafla Hills during the winter of 1874—75, an opportunity was presented of forming collections in a portion of the N. E. Frontier which had never before been visited. It was an opportunity not to be lost, as it would extend considerably the undoubted range of many interesting or little-known Himalayan forms towards the east into the Indo-Burman and West China faunas; while there was also the great probability of discovering new forms, not only among the birds, but in other branches of zoology. On arriving in Calcutta in October 1874, I received much assistance and advice from Messrs. Wood-Mason and G. Nevill, of the Indian Museum, and at the recommendation of the former was permitted to entertain and take with me a native taxidermist, with extra coolies for the carriage of specimens, store-boxes, &c.; my cordial thanks are due for this aid and for the interest shewn by the above-named gentlemen. The list shews that I was tolerably successful, notwithstanding that the force did not penetrate beyond the first large valley at the back of the outer range,

which attains an elevation of from 4000—8000 feet. Had I reached the inner ranges of 10—12000 feet lying beyond, and got out of the region of dense sombre forest, there is no doubt but that my success would have been much greater. It may be said that from Darjiling to this part of the Eastern Himálaya, a distance of 280 miles, the ground had scarcely been worked, for the few mammals, birds, reptiles, &c., collected in Bhútan, or recorded as found there, have mostly come from the portion of the country in the neighbourhood of Darjiling. A few birds were collected by the mission under that zealous and talented explorer Captain Pemberton, in 1838, accompanied by Dr. Griffiths, who was more interested in the botany than in the zoology; while the mission under the hon. Ashley Eden started with a taxidermist, who, owing to the difficulty of obtaining coolies, had to be sent back from Sipchú just beyond Dalingkote, after having only obtained a few ordinary Darjiling species; and Mr. L. Mandelli has, I believe, been lately sending his collectors into the Western Bhutan Doars; but from the Sunkos River, eastward, no naturalist has had a chance of exploring the outer hill-tracts.

I was fortunate in having assistants who took a lively interest in collecting, and my thanks are especially due to Messrs. Ogle and Robert, of the Topographical Survey, and to Mr. J. Lister, of the Botanical Gardens, Calcutta, who was attached to my party to collect botanical specimens. Mr. Robert's zeal and energy have been conspicuous, both here and in the Naga Hills, and the list of species has been largely added to by him. General Stafford and other officers of the force took a lively interest in the birds of the country, and I am indebted to them for several interesting things.

The portion of the Eastern Himalaya occupied by the Dafla Tribe, wherein the collection was made, extends from E. long. 93° to long. 94°, on lat. 27°, or a distance of about 60 miles. The district of Darrung lies along the base of the hills extending south to the Brahmaputra River, with a breadth of about 18 miles.

The hill-portion of the Dafla country is covered from base to summit with dense forest, the larger trees being clothed with thick creepers; and the bottoms of the ravines are occupied by a luxuriant growth of bamboo, canes, tree-ferns, screw-pines, plantains, &c. Such luxuriant vegetation renders the scenery on rivers like the Dikrang and Burroi exceedingly beautiful, but it is monotonous. As one ascends, the underwood becomes thinner, and at 7000 feet the forest is composed almost exclusively of a straight-stemmed bamboo, with oak, rhododendron, and other large trees. Clearings for cultivation are the only open ground seen, and these are of no great extent. The Terai portion between the Dikrang and Burroi, where a good many birds in the list were obtained, is covered with a sea of high grass, intersected with sluggish nullas, the banks of which are generally fringed with forest;

this extends towards and meets the forest belt at the foot of the hills, a belt which occasionally attains a breadth of some 8 miles and is most difficult to work through. On the upper plateaux, such as the Bishnath plain, the grass grows in less luxuriance, the country is much more open, and a change in the birds is noticed at once. Compared with other parts in which I have collected, birds are rare, both in point of number and species, and this is no doubt due to the very large extent of sombre dark forest, all possessing the same character; we were there too rather early in the year and before the advent of a number of species that make their appearance later when the large flowering trees begin to blossom.

In this list I have omitted a number of the Grallatores to be found in the nullas of the Terai, and the list of forms occurring in this part of the Assam valley is by no means complete. Some of the commoner birds, such as *Ploceus baya*, *Copsychus saularis*, &c., are not in the collection, either from not having been shot or considered worth preserving. A flock of stone-plover, probably *Esacus recurvirostris*, Cuv., was seen amongst the boulders in the bed of the Burroi River just within the gorge, but I failed to secure a specimen, and the presence of our camp in the place soon scared them away.

Lord Walden has again most kindly assisted me in the identification and nomenclature, and pointed out many points of interest concerning some of the species.

Duplicates of nearly all the species enumerated have been selected for the India Museum, Calcutta. All species marked with an asterisk have not been recorded in my former lists of birds from the N. E. Frontier.

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4. Gyps Indicus, Scopoli.

5. Gyps Bengalensis, Gmelin.

Both this and the preceding species were seen in hundreds feeding on the dead buffaloes lying along the road-side. Large droves of these animals were passing up towards Debrughur, and numbers were dying daily from some disease, affording a rich feast for the vultures and jackals.

17. Tinnunculus alaudarius, Brisson.

20 *a*. Microhierax melanoleucus, Blyth.

The only species of this genus seen was the above. I noticed it sitting on the topmost twig of a very high tree, from which it sallied forth now and then to capture an insect. Its breast gleamed white against the dark blue sky, but, as it was far out of shot and there was no possibility of getting near the base of the tree owing to the extreme denseness of the underwood and canes, I had to content myself with watching its movements through my binoculars.

53. Circus melanoleucus, Gmelin.

A male and a female were shot in March on the Bishnath plain, where the species was pretty common. Mr. J. H. Gurney has ('Ibis,' January, 1876, p. 130) described the interesting phase of plumage presented by the female bird as follows:—

"Whilst on the subject of harriers I may remark that in 'The Ibis' for 1875, pp. 226—228, I published some notes on the various plumages of *C. melanoleucus;* as an addition to these, I now give some particulars of a harrier of that species, obtained in the month of March in the Darrany (Darrang) district of Assam by Major H. H. Godwin-Austen, and ascertained by that gentleman to be a female; premising that an ordinary adult male was obtained by the same ornithologist in the same month and in the same locality, and that I have been indebted to the good offices of Lord Walden for the opportunity of examining both these specimens. In this female the feathers on the entire upper surface of the head are blackish brown, with narrow rufous edgings; those of the nape are still darker, and without rufous edgings, the entire mantle is of a similar tint, increasing in intensity as it approaches the tips of the lower scapulars, which are almost black. The general hue of the mantle is apparently unbroken, except by narrow buff edgings to the upper interscapulary feathers; but on lifting up the lower scapulars, the feathers which they conceal are found to be grey, barred with blackish brown, which is darkest towards the tip, and in places mottled with white on the inner web; the feathers on the rump are blackish brown, more or less tipped with white; the upper tail-coverts white, with one, or at most two, irregular brown spots in each feather; the tail grey, with six irregular transverse bars and a whitish tip, but no tinge of rufous. The under surface is marked very much as is represented in 'The Ibis' for 1874, Plate X, but with considerably more white on the abdomen, owing to the brown streaks being fewer and narrower; the thighs and under tail-coverts are also white, with a few streaks of brown, varying in both length and breadth. The wings in this specimen show a remarkable approach to the plumage of the adult male; the whole of the lesser wing-coverts are white, but with a broad sagittate mark of dark brown in the centre of each feather, the same coloration being extended over the bend of the carpal joint, and along the anterior edge of the wing to the commencement of the greater coverts; the black band which in the adult male extends from the neighbourhood of the carpal joint to the tips of the tertials, is in this specimen represented by a corresponding band of dark chocolate brown, varied by some of the brown feathers passing, in part, into a decided black, and by a few white spots in that part of the band which is near to the carpal joint; that portion of the wing which is grey in the full-plumaged male is also grey in this female, but with transverse bars of dark brown as in the ordinary plumage of male specimens of intermediate age."

"The principal measurements of this female are as follow: wing from carpal joint 15·8, tarsus 3·3, middle toe s. u. 1·45 inches."

*71. HUHUA NIPALENSIS, Hodgson.

Ex. 52, L. 27, W. 19, T. 10·5, t. 3·5, Bf. 2·75, girth round thigh 5·75 inches, diameter of eyes, which are dark glass-blue with narrow brown irides, one inch, mid-toe and -claw 4·5, inner talon 2·4, ear-tufts 3·25 inches. 1st quill rather short, 4th and 5th equal and longest.

Feet dull yellow; bill pale dingy yellow.

This fine horned-owl was shot in the day-time out of one of the large forest trees now growing on the rampart of the old fort of Purtabghur, in the Darrang district; its presence having been made known by the great excitement it was causing among the other birds, who were paying it a noisy levée. The crows of course were taking the lead and two hornbills *(Hydrocissa albirostris)* were among its visitors; it had probably been sacrificing a neighbour. It is a grand and most powerfully built bird.

80. GLAUCIDIUM BRODIEI, Burton.

Torúpútú Peak, 7300 ft.

81 *a*. NINOX NIPALENSIS, Hodgson.

The *N. scutulata* of Raffles is the Sumatran bird (*vide* note by Lord Walden in the 'Catalogue of the Mammals and Birds of Burmah' by Ed. Blyth, J. A. S. B. 1875). The Ceylon and Malabar birds cannot be separated and must stand as *N. hirsuta*, Tem., but the Himalayan race seems to differ and we ought perhaps to adopt the title *Nipalensis*, Hodgson, for it.

85. HIRUNDO ERYTHROPYGIA, Sykes,

This is the *H. Daurica* of former lists.

*94. CHELIDON NIPALENSIS, Hodgson.

In a clearing above Doripu, a large number were observed, and I shot a couple, much to the delight of the Daflas with me, who had never before seen a bird knocked over on the wing. A swift was also seen at the same time, but I could not get a fair shot, and they soon cleared off.

108 *a*. CAPRIMULGUS JOTOKA, Schlegel.

This bird was particularly numerous at No. 6 camp on the Dikrang. The specimens agree exactly with those I have from the Khási Hills.

109. CAPRIMULGUS ALBONOTATUS, Tickell.

This species has a loud hard chucking note, which it emits at decided intervals "chuck—chuck," a pause, then "chuck—chuck—chuck," another pause, "chuck—chuck," occasionally sounding it four times. *C. jotoka* may be known at once (as I noticed last summer at Shillong, where it is common) by its shorter more softened "chuck," which it repeats continuously and rapidly for long periods at a time, but only when sitting.

117. MEROPS VIRIDIS, Lin.

*135 *a.* ALCEDO GRANDIS, Blyth.

A specimen of this very rare and beautiful kingfisher was shot on the Dikrang River, below Pakfi's village, where I saw one or two others. The original specimen was obtained by Mr. Blyth (J. A. S. B. XIV, p. 190) from the base of the Darjeeling Hills, probably in the Teesta valley, well within the hills. Dr. Anderson got another from the same locality; this specimen is to be found figured in Sharpe's 'Monograph of the Kingfishers,' and is now in the Indian Museum, Calcutta. I have compared the Dafla bird with it; but it is young, with the bill not fully developed, and it is to be regretted that no better example for figuring was then procurable. We failed to find Blyth's original type, but Mr. Mandelli of Darjeeling has kindly sent me a drawing to scale of the bill of one of his own specimens and it agrees exactly in size with that of my bird.

136. CERYLE RUDIS, Lin.

On all the large streams of the Terai.

*137. CERYLE GUTTATA, Vigors.

I saw this large kingfisher several times on the Dikrang river, above camp No. 6; on one occasion four were together, but they are generally solitary. I never perceived it hovering like *C. rudis.* Its flight is very rapid.

An officer of the 42nd Assam Light Infantry shot one, and kindly made me a present of the skin.

138. PSARISOMUS DALHOUSIÆ, Jameson.

Large scattered flocks moving rapidly through the forest were seen in the Dikrang Dhún between Harmutti and the Borpani stockade, keeping to the boughs about halfway up the trees. It is curious how exceedingly well defined in these forests are the haunts of many birds. Some, such as species of *Minla*, *Actinura*, *Liothrix*, *Ixulus*, &c., never appear to descend out of the light beneath the thick canopy of leaves in the crown of the trees, but feed about on them and on the orchidaceous growth that thickly clothes the topmost boughs. Others, like the above-named *Psarisomus*, *Irena puella*, *Criniger flaveolus*, &c., keep well in the shade halfway down, while others, and particularly the fly-catchers *Chelidorhynx hypoxantha* and *Culicipeta cinereocapilla*, remain exclusively in or about the underwood, scarcely ever mounting above it into the larger trees.

The culmen in these specimens was not black (as described by Jerdon), but the bill was green above, pale orange below.

139. SERILOPHUS RUBROPYGIUS, Hodgson.

142. HYDROCISSA ALBIROSTRIS, Shaw.

The commonest hornbill here; another large one with a red head, probably *Rhyticeros plicatus*, was seen in the Dikrang valley but not shot.

149. PALÆORNIS CYANOCEPHALUS, Lin.

Narainpur. The same as the *P. rosa* of former lists.

*152 *a*. PALÆORNIS MELANORHYNCHUS, Wagler.

Common in the tea-garden at Harmutti.

157. PICUS MACEI, Vieill.

*171. GECINUS STRIOLATUS, Blyth.

From the Terai and near Dikráng múkh.

172. GECINUS OCCIPITALIS, Vigors.

173. CHRYSOPHLEGMA CHLOROLOPHUS, Vieill.

176. VENILIA PYRRHOTIS, Hodgson.

Shengorh Peak.

Bill pale yellow; legs dull dusky green; irides dark dull red.

177. GECINULUS GRANTIA, McClelland.

This is called "*Koria*" by the Daflas.

178. MICROPTERNUS RUFINOTUS, Malherbe.

This is the *M. phaioceps* of former lists.

187. SASIA OCHRACEA, Hodgson.

192. MEGALÆMA HODGSONI, Bonap.

195. CYANOPS ASIATICA, Latham.

196. MEGALÆMA FRANKLINII, Blyth.

207. HIEROCOCCYX SPARVERIOIDES, Vigors.

Young female,—Dikrang valley.

218. CENTROPUS BENGALENSIS, Gmelin.

Young male.

223. ARACHNOTHERA MAGNA, Hodgson.

229. ÆTHOPYGA NIPALENSIS, Hodgson.

Shengorh Peak, at 6000 ft. I have always found this honey-sucker ranging higher than any other of the genus.

231. ÆTHOPYGA SATURATA, Hodgson.

Common in the Harjúli,* and along the outer sandstone range.

*245. CERTHIA DISCOLOR, Blyth.

The specimens from the Dafla hills agree perfectly with examples in the Indian Museum, Calcutta, with which I compared them. I give the description.

Head black with a medial pale ochreous streak and another over the eye; back streaked with pale ochre and dark brown; upper tail-coverts ferruginous; tail rufous. Chin and throat dull pale brown; belly paler; under tail-coverts pale rusty; primaries black with a pale ochreous band, with subterminal spots and terminal spots on all except the first three; coverts black and spotted. Bill black above, ruddy beneath; legs horny.

L. 6·0, W. 2·75, T. 3·0, t. 0·68, Bf. 0·55 inches.

* Júli, a ravine in the local dialect.

261. SITTA CINNAMOMEOVENTRIS, Blyth.

I obtained several of this species in the large trees that have been left standing in the tea-garden at Harmutti. They were haunting the holes in the stems and preparing to commence breeding. The tail is very square in this species.

252. SITTA FORMOSA, Blyth.

Was occasionally seen and two specimens were secured under Torúpútú Peak at about 5000 ft.

253. DENDROPHILA FRONTALIS, Horsf.

According to Mr. R. B. Sharpe ('Stray Feathers', Vol. III, p. 436), this bird will stand under Hodgson's name *corallina*, *frontalis* being the Malayan form, which is distinguished by the pure white colour of the throat.

254. UPUPA EPOPS, Lin.

258. LANIUS TEPHRONOTUS, Vigors.

263. TEPHRODORNIS PELVICA, Hodgson.

Darpang nulla at the base of the outer hills.

269. VOLVOCIVORA MELANOSCHISTUS, Hodgson.

270. GRAUCALUS MACEI, Lesson.

271. PERICROCOTUS SPECIOSUS, Lath.

273. PERICROCOTUS BREVIROSTRIS, Vigors.

278 *b*. DICRURUS CATHŒCUS, Swinhoe.

Assam birds agree very well with those from China, save that the tail is rather longer. This is included in my former list as *D. longus*, which is the title of the Javan form.

280. DICRURUS PYRRHOPS, Hodgson.

282. CHAPTIA ÆNEA, Vieillot.

Harmutti and Dikrang valley.

283. BRINGA REMIFER, Temm.

In non-breeding plumage (Dec.) on the Niosi ridge near Tanir Peak, a good many seen.

284. DISSEMURUS GRANDIS, Gould.

286. CHIBIA HOTTENTOTA, Lin.

Irides dark reddish brown; legs and feet black.

289. TCHITREA AFFINIS, A. Hay.

291. LEUCOCERCA ALBICOLLIS, Vieillot.

294. CHELIDORYNX HYPOXANTHA, Blyth.

Very common.

295. CULICIPETA CINEREOCAPILLA, Vieillot.

301. EUMYIAS MELANOPS, Vigors.

*303. CYORNIS UNICOLOR, Blyth.

A single specimen of this rare fly-catcher was obtained in the Dikrang valley.

315. Niltava Macgrigoriæ, Burton.

316. Niltava grandis, Blyth.

Shengorh Peak, at 6000 ft.

319. Siphia strophiata, Hodgson.

A male from Torúpútú Peak, and a female from the Dikrang valley. I observe that this female differs a good deal from the description of the male, which alone is given by Jerdon. Above she is similar throughout, except that the frontal band is absent, there being a very slight pale grey indication of it. The throat is grey in lieu of black; breast and abdomen dull white, the flanks olivaceous. The rufous gorget is very pale; indeed, there is only just an indication of it.

323. Erythrosterna leucura, Gmelin.

Irides dark brown.

Harmutti tea-garden.

343. Myiophonus Temminckii, Vigors.

344. Hydrornis Nipalensis, Hodgson.

350. Zoothera monticola, Vigors.

Only one specimen was obtained. This has a very dark coloured plumage throughout, much darker than any other I have examined.

355. Geocichla citrina, Latham.

366. Turdus (Planesticus) fuscatus, Pall.

Shot at Harmutti.

373. Paradoxornis flavirostris, Gould.

Only in the high grass of the low plain country skirting the hills.

*378 *b*. Suthora Daflaensis, Godwin-Austen. Plate III.

I described this very interesting little bird in the Annals and Mag. Nat. History for December 1875. I give below a copy of the original description, together with some account of the habits of the genus, which are quite parine. It is closely allied to *S. Munipurensis*, Wald. and G.-Aus., described in 'The Ibis', 1875, p. 250. The difference between them is most marked on the under side, the chin being grey in the Dafla bird, paling on the upper breast and belly to dull yellowish white, while in the Munipur and Nágá species the chin and throat are deep black, fading to grey on the breast and thence into the white of the lower tail-coverts. There is besides a marked difference in size, especially in the bill and legs; this new form being the smallest of the genus now known.

Desc.—"Above; crown of head chrome-brown, back and rump rusty olivaceous brown; tail very rich rusty brown, particularly near the base; frontal band, passing over the eye to the nape, black; a white circle round eye, with a moustachial streak passing down the side of the neck of the same colour; ear-coverts grey, surmounted by a small streak of golden yellow. Chin grey; breast and belly dull sordid white; under tail-coverts

white; flanks grey. Shoulder of wing olivaceous; primaries black, rufous at the base, forming a band, the outermost edged white; their coverts black: secondaries grey, edged rich rufous on the outer web, with a narrow white edging to the inner. Irides dark brown; legs and feet pale grey; bill neutral grey.

"L. 3·25, W. 1·75, T. 2·10, t. 0·62, Bf. 0·25 inches.

"*Hab.* The bamboo underwood of the forests at 5000—7000 feet, first obtained on the slopes of Torúpútú Peak in January.

"These curious little birds associate together in large flocks, making an incessant sharp twitter. They are most active, flitting rapidly about the foliage of the bamboos, of which the underwood is principally composed. They were the most fearless birds I ever met with, perching on twigs within a couple of yards of one's head, so close that it was some time before I could fire at one without the certainty of blowing it all to pieces, and two specimens obtained I had to throw away. The bright-coloured top of the head, set off with its black coronal edging, is conspicuous as they fly and hop about the branches."

*382. Grammatoptila striata, Vigors.

This was a bird seen and heard more than any other at about 6000 feet in January. It was particularly abundant under Torúpútú Peak, associating in large flocks, their note a chatter mingled with another call somewhat simulating the low quack of a duck. On examination of several birds they proved to be fruit- and seed-eaters solely, but insect life was at the time very scarce. Irides red brown; legs and feet pale grey.

L. 10·5, W. 5·5, T. 5·75, t. 1·75, Bf. 0·95 inches.

I have noticed in these forests that many species of gregarious babbling-thrushes associate together, and I have seen as many as three in the same large and numerous flock. The large and noisy white-crested babblers *(Garrulax leucolophus)* often have other species in their train, among others I once shot *Pomatorhinus ferruginosus.* The same habit is to be observed with many of the *Liotrichinæ:* for long distances not a bird is to be seen or heard, all is as silent as if no life whatever existed; when suddenly one comes upon a whole assemblage of birds, all actively feeding and an incessant chirping and twittering are going on on all sides; they pass on through the forest and all is still again.

384. Gampsorhynchus rufulus, Blyth.

One specimen possesses an incipient collar, but differs in no other respect. Mr. Hume has separated this phase or variety of colouration under the specific title of *G. torquatus,* but I doubt whether so small a variation however interesting and worthy of record is enough to entitle the bird to a distinctive title. Lord Walden has remarked to me that the collar probably denotes a full stage of plumage.

385. Pyctorhis Sinensis, Gmelin.

*386 *a*. Pyctorhis altirostris, Jerdon.

In this bird I at first considered I had got a new species, but it agrees so well with *Chrysomma altirostre*, Jerdon, described in the 'Ibis' 1862, p. 22, that I do not hesitate to identify it, although Dr. Jerdon's bird is described as from Thayet Myo on the Irrawady, Burmah, where it has not again turned up, notwithstanding that this place has since been well worked by Mr. Oates, Captain Fielden, and others. Although the paper in which Dr. Jerdon describes *C. altirostre* purports to be exclusively one on birds then lately obtained by him in Burmah, yet I am inclined to think that he may have had before him one or two species from Assam. Twice in the paper (pp. 19 and 23) he writes "Brahmaputra River" when he should have written "Irrawady", so that there is just the possibility that *P. altirostris* was from the same country where I found it so abundant, yet Dr. Jerdon in 1862 had not visited Assam and did not do so until ? 1868.* What has become of Dr. Jerdon's type specimen I cannot ascertain, but the hoary frontal band and peculiar short bill are conspicuous characters; it will be very interesting hereafter to compare *altirostre* from Burmah, should it ever turn up there. As slight differences may exist, I give a description of the Assam bird, which I found to be by no means uncommon in the grass of the Bishnath plain. I first shot it from off an elephant near the embouchement of the Burroi River, and altogether secured four specimens, one of which, with many others in this list, I have sent to the Indian Museum, Calcutta. It is in every respect a true *Pyctorhis*. Jerdon says very rightly, it may be on only a cursory glance mistaken for *Pyc. Sinensis*, but on a more attentive examination, or on comparison with the latter, its distinctness is at once apparent.† It is a difficult bird to shoot, its habits being so very skulking, and when once frightened it will not rise again. It is also a much more solitary bird than *P. sinensis*, which associates in considerable flocks, and I never found more than two or three together.

Desc.—Above dark ruddy brown, brightest on the head, primaries, and outer edging of the tail-feathers; frontal band, over the eye, and ear-coverts hoary; in some specimens less white is mixed with the dark grey than in others. Chin pale grey, merging gradually on the breast into pale rusty ochre and on the flanks, belly, and under tail-coverts into ferruginous. Irides (very narrow) pale sienna; orbits yellow; bill ruddy brown, pale ruddy below.

L. 6·25, W. 2·45, T. 3·8, t. 1·08, Bf. 6·42 inches.

* Since writing this Mr. W. T. Blanford says *(in epist.)*, "I remember seeing the specimen at Thayet Myo. I was there with Jerdon, you know."

† Mr. Hume (in 'Stray Feathers', Vol. III, p. 115) refers to *altirostre*, but the birds he had under review were evidently, as he says, nothing but *P. Sinensis*.

The bill is more curved, higher, and shorter than in *Sinensis*, in which moreover it is deep black.

388. Alcippe Nipalensis, Hodgson.

390. Turdinus Garoensis, G.-Austen.

I was very fortunate in obtaining a second example of this new bird and can now add the colouration of the soft parts and dimensions from the flesh, those already given (J. A. S. B., Vol. XLIII, page 160) having been taken from a carbolized specimen.

L. 5·5, W. 2·5, T. 2·3, t. 1·15, Bf. 0·53 inches.

Irides red brown; legs very pale fleshy.

Proceeding through the dense underwood in the Dikrang valley, I caught sight of this bird on the narrow path about two yards from my feet, and at the first glance took it to be a small rodent. It was most fearless, and made no attempt to fly off, but caught an insect while I stood and watched it. I had to step back several yards before I could shoot it without blowing it to atoms.

391. Strachyrhis nigriceps, Hodgson.

From the jungles near Harmutti, near the base of the hills,—common.

394. Strachyrhis chrysea, Hodgson.

Shengorh Peak.

395. Mixornis rubricapilla, Tickell.

396 *a*. Timalia Bengalensis, G.-Austen.

400. Pomatorhinus ruficollis, Hodgson, var.

Dafla birds are similar to those from Darjeeling, but do not agree with those from Nipal and the Naga Hills, the former being very much more ruddy throughout and darker olive above. The most striking difference lies in the size of the legs and in strength of the toes and claws.

Dimensions—Dafla and Darjeeling,	t. 1·25,	hind toe 1·0,	claw 0·60	in.
Do. Nipal,	t. 1·05,	„ 0·75,	„ 0·45	„

*401. Pomatorhinus ferruginosus, Blyth.

"*Pot gongor*" of the Daflas.

This handsome scimitar-babbler appeared very numerous under Torúpútú Peak, about 5000 feet. It is gregarious, but not a noisy bird, uttering only a faint chirp.

Irides pale greenish yellow; bill crimson; legs dull green.

L. 8·75, W. 3·5, T. 4·2, t. 1·3, Bf. 1·0 inches.

402. Pomatorhinus schisticeps, Hodgson.

405 *b*. Pomatorhinus hypoleucos, Blyth.

The specimen obtained is larger than any I have from the hill-ranges south of the Brahmaputra, but agrees in all other respects.

407. Garrulax leucolophus, Hard.

This was found to be as numerous here as in other parts of the adjacent hill-states.

409 *a*. Garrulax gularis, McClelland.

From Borpani in the Dikrang Dhún. Appears never to range higher than 2000 feet or so. It is a rare bird, and I only shot two specimens.

412. Garrulax pectoralis, Gould.

413. Garrulax moniliger, Hodgson.

"*Poréri*" or "*Purirhi*" of the Daflas.

416. Trochalopterum chrysopterum, Gould.

Solitary, in pairs. Its call low.

Shengorh Peak, 7000 ft., in February.

L. 9·0, W. 3·5, T. 3·85, t. 1·5, Bf. 0·77 inches.

420. Trochalopterum squamatum, Gould.

421. Trochalopterum rufigulare, Gould.

Dafla examples agree with those from Darjeeling. Individuals differ in the colouration of the wing-bar: in all Khási and Gáro birds and in one from Darjeeling this is concolorous with the coverts, *viz.*, olive-brown, the lores sometimes rufous. The normal colouration (? full) is pearly grey on the breast and white in front of the eyes. Khási examples have the rufous of the chin extending well down on to the breast.

L. 9·0, W. 3·6, T. 4·0, t. 1·48, Bf. 0·76 inches.

Bill grey above, very pale yellow below; legs and feet very pale horny; irides very dark purple-red.

Found associating in pairs, shy and not easy to find in the underwood. Their call is a sharp, monotonous kind of chirp, as they answer each other.

427. Actinura Egertoni, Gould.

The specimen shot on Shengorh Peak is much more rufous than the Khási bird; this has led me to look at the series at my disposal with more attention. In my first list of birds (J. A. S. B., 1870, p. 105), the latter is recorded as a variety. I noted at the time I shot the first specimen at Asalu that it did not accurately agree with the description of *A. Egertoni* in Jerdon's 'Birds of India', and Dr. Jerdon himself, on my subsequently shewing him the bird, agreed that there were differences, but we had then no Darjeeling specimens to compare it with. I mentioned the points in which the Khási bird differed and I now see that not the least important of these is the distinct difference in the colour of the shoulder of the wing, the back, and the rump; which is an ochrey olivaceous, but in the Dafla specimen it is red-brown as given by Jerdon for the same parts of true *Egertoni*. All the birds (and I have a large series from the hill-ranges south of the Brahmaputra) are identical, and so distinct from the *Egertoni* of the Eastern Himálaya that they must receive a specific title, which I propose should be *A. Khasiana*, or, as I would rather designate races differing like this so slightly from an older well-known form, *A. Egertoni*, Gould, var. *Khasiana*; and in like manner we might indicate the relations of

such forms as *Trichastoma minor*, Hume and *Microperdix Blewitti*, Hume by calling them *T. Abbotti*, Blyth, var. *minor; M. erythrorhyncha*, var. *Blewitti;* and the same might be done with several other closely allied species.

427 *b*. ACTINURA DAFLAENSIS, G.-Austen. Plate IV.

Among the birds collected one of the most interesting forms is the *Actinura* described in 'Annals & Mag. Nat. Hist.' for November 1875, and of which the original description is repeated below.

"As might be expected, its nearest ally is *A. Nipalensis*, Hodgs., the colouration above being very similar on the back and tail, but with less rufous barring. The crest, however, is quite different; and in this respect the species approaches *A. Waldeni* from the Naga hills, on the south of the Brahmaputra valley, only that the crest is far fuller. The general blotchy streakiness of the throat and breast is also a mark of connexion with *A. Waldeni.* On comparison, it is seen that *Actinura Daflaensis* bears the same relation to *A. Nipalensis* that *A. Waldeni* does to *A. Egertoni.*

"The genus is a very well-marked one; and we can now record from the Indian region five species (including *A. Ramsayi* from Tonghoo, in Burmah, described by Viscount Walden in 'Ann. & Mag. Nat. Hist.' for June 1875), *viz.*:—1. *A. Egertoni*, Gould; 2. *A. Nipalensis*, Hodgson; 3. *A. Waldeni*, Godwin-Austen; 4. *A. Daflaensis*, Godwin-Austen; 5. *A. Ramsayi*, Walden. The last is a very distinct and interesting bird, a departure from the East-Himalayan type, but yet in every point a true *Actinura.*

"*Male.* Above; head ash-brown; feathers in front spatulate, behind elongated into a full crest, narrowly pale-edged; the ash tint pales on the back of the neck, and merges into the strong rusty brown of the back and upper tail-coverts; base of tail-feathers of the same colour, followed by four or five black bars, and the terminal half all black; the three outer rectrices tipped white, with a slight tendency to barring on the extreme outer web; side of head ash-grey, the ear-coverts with light silky reflections; shoulder of wing rusty brown; first primary coverts tipped with grey, forming a distinct narrow band, the last (covering the first seven primaries) black, forming a patch; the primaries are sienna-brown, the outermost edged with hoary grey, black on the inner webs and extremities, and narrowly barred with black on the terminal outer web; secondaries evenly and narrowly barred black and pale olivaceous umber. Beneath; the chin and throat pale dingy white, becoming a dirty ochrey ash on the breast, with a blurry striation, particularly on the throat; flanks and under tail-coverts rusty brown; tail beneath ashy black, the outermost feathers distinctly barred. Bill dark horny; legs the same; irides—?

"L. 7·5, W. 3·5, T. 3·2, t. 1·3, Bf. 0·68 inches.

"*Hab.* In high forest at 7000 feet, and first shot on Shengorh Peak in February."

*430. Sibia picaoides, Hodgson.

Its range appears to extend up to about 3000 ft.

430 *a.* Sibia pulchella, G.-Austen.

I obtained several specimens of this bird on the slopes of Torúpútú Peak at about 5000 ft. It was first obtained by me in the Nágá Hills, and it was interesting to find it extending to this side of the Assam valley.

*432. Malacocircus terricolor, Hodgson.

I have never got this bird on the south side of the Brahmaputra or in Cachar, and I did not see many even here in the Darrang district.

437 *a.* Malacocircus (Layardia) rubiginosus, G.-Austen.

It was a great pleasure to find this bird again and in Assam, so far from the locality in which it was first discovered by me in Munipur. Beating through some grass for florikan, near Helem, in the Darrang district, some ruddy birds were flushed which quickly hid themselves low down in the stuff and could not be driven out, although the elephants were put through and through it in every direction. I suspected they belonged to the above species, but they were far more wary and concealed themselves more than those I had seen in Munipur. Several times afterwards similar birds were put up and a snap shot was obtained off the pad of the elephant as they scudded along for a few yards and dropped completely out of sight into the thick grass. The chase at last became quite exciting, as I was determined to find out what they really were. At last coming on a numerous party in an outlying patch of grass, I dismounted and, sending the elephants to be put in at the opposite end, had the piece beaten up towards me; as the birds flew across an open space where the grass had been burnt, I managed to secure a couple and so clear up the doubt that hung over their identity. I afterwards obtained, with the assistance of Mr. M. J. Ogle of the survey, two or three others. From the back of an elephant, they afford a most difficult shot: the flight is jerky, and unlike other grass haunting species, these birds very seldom when driven perch on the higher stalks before settling into the cover, but shuffle right down into the latter at once, and then continue moving through it very rapidly and out of sight, so that in a few minutes they are yards distant from the spot at which they originally alighted. When hunted in this way, they separate also and straggle in all directions; which adds to the difficulty of finding them again. I found it a far better plan not to waste time over them, but to beat on again for another flock.

439. Chatorhea Earlei, Blyth.

440. Megalurus palustris, Horsfield.

444. Hypsipetes psaroides, Vigors.

The species in my former list, (p. 106) is this, not *H. concolor*.

448. Hemixus flavala, Hodgson.

449. Alcurus striatus. Blyth.

Torúpútú Peak. January.

451. Criniger flaveolus, Gould.

A very abundant bird in the lower ground about Harmutti and Harjuli.

460 *a*. Otocompsa monticola, McClelland.

This bulbul was a very abundant bird in the low country.

466. Phyllornis Hardwickii, Jard. and Selby.

468. Iora typhia, Lin.

469. Pycnonotus pygæus, Hodgson.

474. Oriolus Traillii, Vigors.

477. Myiomela leucura, Hodgson.

On Torúpútú Peak. This genus should certainly be placed near *Niltava*.

*498. Ruticilla Hodgsoni, Moore.

500. Ruticilla aurorea, Pallas.

505. Ruticilla fuliginosa, Vigors.

Dikrang valley.

506. Chimarrhornis leucocephala, Vigors.

Dikrang valley.

573. Calliope pectoralis, Gould.

Dikrang valley.

530. Orthotomus longicauda, Gmelin.

Narainpur and Harmutti—in plains.

532. Prinia flaviventris, Deles.

Very numerous in the shorter grass of the Terai and on the Bishnath plain.

*534. Prinia socialis, Sykes, small var.

This little bird was the most numerous wren-warbler in the Darrang District, and I shot a large series of it.

I generally found them in the patches of shorter grass near the foot of the Dafla Hills from the Burroi River to the Bishnath Plain, associated with *P. flaviventris*, *Graminicola Bengalensis*, and *Pyctorhis altirostris*. Their pale rufous breasts and grey backs distinguish them at once from other species directly they rise out of the grass; they then fly with a short jerking flight a short distance, settle on a stalk for a few seconds, and then drop into the cover beneath. The specimens obtained are certainly smaller than those of *P. socialis* from Southern India, but I see little or no other distinction.

L. 5·25, W. 1·7 to 1·8, T. 2·75 to 2·8, t. 0·72, Bf. 0·4 to 0·48 inches.

Irides bright reddish brown; legs pale flesh-coloured.

Dr. Jerdon's measurements of the wing and tarsus greatly exceed the above, being 2·1 and 0·9 in. respectively.

*535. Prinia Stewarti, Blyth.

One example of this species was obtained on the Bishnath plain.

539 *a*. Cisticola melanocephala, And.

539 *b*. Cisticola Munipurensis, G.-Austen.

542. Graminicola Bengalensis, Jerdon.

Very abundant on the Bishnath plain.

Bill nearly white below, dark horny above; irides red-brown; legs and feet pale fleshy.

L. 6·0, W. 2·25, T. 3·16, t. 0·9, Bf. 0·5 inches.

544. Drymœpus longicaudatus, Tickell.

555. Phylloscopus fuscatus, Blyth.

Only found in the woods of the Terai.

561. Phylloscopus affinis, Tickell.

Only seen in the plains.

572. Abrornis xanthoschistos, Hodgson.

578. Abrornis castaneoceps, Hodgson.

Harmutti.

585. Henicurus immaculatus, Hodgson.

Dikrang velley.

L. 10·0, W. 4·0, T. 5·5, t. 1·3, Bf. 0·8 inches.

*586. Henicurus schistaceus, Hodgson.

Several specimens were obtained in the Dikrang valley. Leaving the main stream and proceeding up the bed of any of the small tributaries, almost the first bird seen would be a pair of this species, flitting with their peculiar jerking flight and settling a short way up stream on the gravelly bed. When disturbed by a shot they fly into the dense underwood and do not shew themselves again. Another pair would soon be found higher up.

Irides dark umber; legs fleshy white.

L. 10·0, W. 3·9, T. 5·5, t. 1·15, Bf. 0·7 inches.

*587. Henicurus Scouleri, Vigors.

I first became acquainted with this very diminutive representative of the genus on the Dikrang River, where it was very numerous, flitting about the large rocks and boulders. It is not such a lover of confined overgrown ravines as its much larger allies recorded above.

Irides very dark brown; legs and feet white; the two outer tail-feathers pure white, not tipped black (*conf.* Jerdon).

L. 4·75, W. 2·75, T. 2·0, t. 0·85, Bf. 0·42 inches.

588 *a*. Henicurus Sinensis, Gould, Birds of Asia, Pt. XVIII.

The Dafla specimens have been compared with typical *H. Leschnaulti* from Java and with *H. Sinensis* from China, obtained by Swinhoe. The frontal patch, as noticed by Captain Elwes in his revision of the genus ('The Ibis' 1872), is not a reliable character, and the only distinction appears to be that of size, the China bird being altogether larger. My specimens

again are markedly larger than *H. Sinensis* especially in the bill; which removes them still further from the Javan race.

L. 10, W. 3·9, T. 5·5, t. 1·15, Bf. 0·7 inches.

*590 *a*. Motacilla Hodgsoni, G. R. Gray.

If really distinct from *M. Luzoniensis*, my specimen is evidently the above; it was obtained at Tezpur on the 27th November.

Desc.—Above; all sooty black, more velvety on the head, this colour extends round the sides of the neck, ear-coverts, throat, and moustachial streak from the gape; shoulder of wing a paler brown-black; quills and secondaries brown, white-edged, the latter strongly so; the primary coverts very broadly edged with white, so as to form a wing-band; a broad frontal band extending over the eye as far as the posterior limit of the ear-coverts, white; white also on the lores, chin for half an inch, and a narrow line under the eye, this colour has a tendency to replace the black on the throat and sides of the neck; abdomen and outer tail-feathers white the latter with a very narrow black edging near the base of the inner web, the next pair also white with a broader edging extending nearly to the tip.

*592. Calobates melanope, Pallas.

593. Budytes viridis, Gmelin.

Got in December at Narainpur.

596. Pipastes agilis, Sykes.

Numerous in the Dafla clearings, attracted by the millet-crop which was being cut in December.

609. Pterythrius erythropterus, Vigors.

L. 6·5, W. 3·4, T. 1·8, t. 1·1, Bf. 0·58 inches.

Bill beneath greenish grey; legs pale flesh-coloured; irides umber.

*612. Cutia Nipalensis, Hodgson.

(Púting, Dafla.)

It was quite a pleasure obtaining this bird for the first time on account of its peculiar and beautiful colouration, as well as the very great difference between that of the males and females. Mr. Lister, attached to the survey party for the purpose of forming a botanical collection, was the first to bring it in to me, he having shot four one after the other out of a large flock on the same tree, the birds being apparently quite scared by the report of the gun and not flying away. It is well-known on the Darjeeling side, but I have not yet met with it south of the Brahmaputra. The males besides their different colouration are rather larger than the females.

♂ L. 6·75, W. 3·65, T. 2·7, t. 1·15, Bf. 0.68 inches.

♀ L. 6·50, W. 3·25, T. 2·42, t. 1·10, Bf. 0·57 „

Irides umber-brown; legs and feet yellow.

615. Liothrix argentauris, Hodgson.

616. Siva strigula, Hodgson.

617. SIVA CYANUROPTERA, Hodgson.

619 *a*. ALCIPPE COLLARIS, Walden.

Is very probably *Minla rufogularis*, Mandelli ('Stray Feathers,' Vol. I, p. 416) and specimens from Darjeeling must be compared. The species were described by the above gentlemen about the same time. Should the two prove identical Mr. Mandelli's title has priority. It is pretty numerous at about 3000 ft. in these hills. Mr. Mandelli's single specimen came from the Bhútan Doars. I consider the species to be a *Minla*.

Dimensions in the flesh:—L. 5·0, W. 2·3, T. 2·2, t. 0·9, Bf. 0·44 in.

*619 *b*. MINLA MANDELLII, G.-Austen.

Described as below in the 'A. and M. N. H.' for January 1876.

"Above dark olivaceous, tail brown; forehead rufous, merging into the olivaceous brown of the top of the head; a white supercilium commences from above the eye, and extends to the neck, merging into some streaky buff and black feathers behind the ear-coverts; a black band surmounts the white one, but does not meet the black lores; ear-coverts sooty. Chin, throat, and upper breast buffy white; sullied white on abdomen, flanks olivaceous. Irides dark red-brown; legs and feet pale fleshy; bill grey-brown. Feathers of the head scaly."

L. 5·5, W. 2·2, T. 2·5, t. 0·95, Bf. 0·45 inches.

I named this bird after Mr. L. Mandelli, who has so successfully worked the ornithology of the Sikkim Hills, and who has described a near ally of this species. Since forwarding the communication to the 'Annals', I see that Mr. Hume (in 'Stray Feathers' for 1874, p. 447) has described a *Proparus* under the title of *dubius* which is so like my bird, that I am inclined to think the two will prove identical, in which case the specific title *Mandellii* will not stand, but I should certainly not place it in the group *Proparus*, as it is in every respect similar in form to *Minla ignotincta* and *M. castaniceps*.

Wherever I have found this and *Minla collaris*, the whole country has been covered with forest, and I should certainly not call them reed- or grass-haunters. The *Liotrichine* group is already too much sub-divided and I would not recommend the adoption of another genus for these two species as proposed by Mr. A. O. Hume under the title *Schœniparus*.

*621. PROPARUS CHRYSÆUS, Hodgson.

This very lovely tit was got on Shengorh, out of a numerous flock that passed through the trees near the camp.

L. 3·9, W. 2·0, T. 1·9, t. 0·8, Bf. 0·3 inches.

623. IXULUS FLAVICOLLIS, Hodgson.

Shengorh Peak.

624. IXULUS OCCIPITALIS, Blyth.

628. YUHINA NIGRIMENTUM, Hodgson.

Shengorh Peak.

630. HERPORNIS XANTHOLEUCA, Hodgson.

Harjuli 3000 ft. up to Torúpútú Peak.

645. PARUS NIPALENSIS, Hodgson.

The *cinereus* of my former lists is shewn to be the Javan race by Lord Walden in the 'List of Birds of Burmah', p. 112.

647. DENDROCITTA HIMALAYANA, Blyth.

660. CORVUS CULMINATUS, Sykes.

Large numbers were attracted to Narainpur on the formation of the camp there.

663. CORVUS SPLENDENS, Vieillot. (C. IMPUDICUS, Hodgson).

In the camps of Narainpur and Harmutti only.

673. SISSA CHINENSIS, Bodd.

"*Pilitel*" of the Daflas.

678. DENDROCITTA FRONTALIS, McClelland.

683. STURNOPASTOR CONTRA, Lin.

688. TEMENUCHUS MALABARICUS, Gmelin.

702. MUNIA ACUTICAUDA, Hodgson.

Seen only in the plains.

706. PASSER INDICUS, Jard. and Selby, var.

723. EUSPIZA AUREOLA, Pallas.

754. MIRAFRA ASSAMICA, McClelland.

766. ALAUDA GULGULA, Franklin.

773 *a*. CROCOPUS VIRIDIFRONS, Blyth.

776. OSMOTRERON PHAYREI, Blyth.

781. CARPOPHAGA INSIGNIS, Hodgson.

These birds were pretty common at No. 9 camp in the Dikrang valley.

793. TURTUR MEENA, Sykes.

Harmutti.

803 *a*. POLYPLECTRUM TIBETANUM, Lin.

Not so plentiful as in the hills south of the Brahmaputra, Mikir, Naga, &c.

811 *a*. GALLOPHASIS HORSFIELDII, G. R. Gray.

Occurs at the base of the hills.

812. GALLUS FERRUGINEUS, Gmelin.

Found all along the Terai, but did not appear to be very abundant.

818. FRANCOLINUS VULGARIS, Stephens.

Plenty were seen on the Bishnath plain.

823. ORTYGORNIS GULARIS, Temminck.

Very plentiful, in the high grass plains, near water, but far oftener heard than seen. They are very difficult to flush, and I have more than once, when sitting on the pad of the elephant, seen them crouching in the

grass close to the elephant's feet and not rising until actually kicked up.

825. Arboricola rufigularis, Blyth.

"*Pokhú*" Dafla.

This was the only species obtained, and it was very common at 4000 feet and upwards at our camp in the forest under Torúpútú Peak, and the Dafla guides snared several. The Daflas, like the other hill-tribes, are clever at this art, and the mode of capturing pheasants and partridges is simple and worth describing. As it is the habit of the birds to get down low at night into the warmer ravines and feed upwards along the crests of the spurs, they stop the progress of the covey by a zig-zag barrier about 2 to 3 feet high, made up of twigs and short pieces of bamboo stuck into the ground, which is rapidly formed and extended a short distance down the hill on either side. A narrow opening is left here and there, generally at the re-entering angles, and in this the noose is set just above two cross sticks and in the same plane, at exactly the height of the bird's breast. The noose-string is made of a thin strip peeled off the outside of a bamboo, and tied to the end of a pliant stick, drawn down like a spring, and hitched into a saw-nick in a bamboo peg, into which the flat form of the string forming the noose fits close and accurately. All the materials grow on the spot, and in a few hours hundreds of barriers and snares can be made and set. The birds are often caught alive by the legs, and I had one thus captured for several days, but it refused food and died; it was probably in some way injured, for they are not difficult birds to keep in captivity, and large numbers are brought to Calcutta for transfer to Europe.

831. Excalfactoria Chinensis, Lin.

*838. Sypheotides Bengalensis, Gmelin.

Numbers are to be seen on the Bishnath plain. In the early morning they are constantly on the move, taking long flights from one feeding ground to another, and are then very wary; as the heat increases, they lie very close and are often difficult to flush, and if the sportsman is on foot, they will hide and often elude him altogether. I found the best plan was to walk along about 50 yards in front of the elephants when the grass would admit of it.

870. Gallinago stenura, Kuhl.

905. Gallinula chloropus, Lin.

917. Mycteria Asiatica, Lath.

Often seen in the Darrang District, and I shot a fine specimen. I once saw this bird breeding in the extensive marshes near Shushang, Mymensing, in January. It had formed its nest on the top of a thick bushy mass of trees about 30 feet high, which stood in the midst of a dense thicket of a species of rose, so thick that the elephants could not push into it, and it

was practically inaccessible. The nest consisted of a very large accumulation of sticks and reeds.

931. Butorides Javanicus, Horsfield.

On all the large wooded rivers and streams.

*981. Larus ridibundus, Lin.

This bird, which Mr. Howard Sanders has kindly identified, was shot near the junction of the Dunsiri and Brahmaputra in December. From the colour of its bill and legs it rather puzzled me, for I was well acquainted with *brunneicephala*, which is a common gull on the above river. It is interesting finding the laughing-gull so far up the Brahmaputra, at this point some 500 miles from the sea. Jerdon mentions its being abundant at the mouths of the Ganges.

*987. Sterna melanogastra, Temminck.

A very common tern on the Brahmaputra and its larger tributaries, such as the Dikrang, as far up as sand-banks occur.

IX.—*On the Physical Geography of the Great Indian Desert with especial reference to the former Existence of the Sea in the Indus Valley; and on the Origin and Mode of Formation of the Sand-hills.—By* W. T. Blanford, *F. R. S.*

(Received June 31st;—Read July 5th, 1876.)

Contents.

§ 1. *Introduction.—Geological distinction between the Indian Peninsula and the neighbouring portions of Asia.*—There is no tract of country in India more singular in its character than that which is commonly known as the Great Desert, lying on the eastern side of the Indus between Sind and Rájpútana. The peculiar nature of the region has often been described, but there are still some points in its physical geography which appear to require explanation, and which are not, I think, entirely cleared up in the best account of the region with which I am acquainted, that given by Sir H. B. E. Frere in the Journal of the Royal Geographical Society for 1870, Vol. XL, p. 181. To these points, which chiefly refer to the origin of the sand-hills, I shall advert in the sequel.

The physical geography of a country is always intimately connected with its geological construction and history, and from this point of view the Great Desert is a tract of peculiar interest. It is almost a truism at the present day to state that India proper has no geological connexion with the surrounding countries. The whole geological history of the Indian peninsula, from the date of the earliest sedimentary formations, shews scarcely a trace of similarity to that of the Himalayas* or the countries west of the Indus or east of the Bay of Bengal. Wherever remains of sedimentary beds are found throughout the peninsula, of any age from the

* The only exception of any importance is the occurrence of Damuda rocks in Sikkim and Assam.

dawn of organized life to the present day, they consist with but few and local exceptions of rocks which have been formed, in all probability, on the surface of the land; the only case of a marine formation known to exist at a distance of more than 100 miles from the present coast being that of the thin Cretaceous band at Bágh, Barwai, and elsewhere in the western part of the Narbadda valley. On the other side of the great alluvial plain formed by the Indus and Ganges all is different. Marine rocks of various ages form the hills of Sind and the Panjáb, the greater portion of the Himalayas and Tibet (so far as the mountains do not consist of metamorphic rocks), the ranges south of the Assam valley, and the hills of Arrakan and Burmah. Only the later tertiary deposits in Sind, the Panjáb, Northern India, Assam, and Burmah are, as a rule, of subaërial origin and accumulated by the action of fresh water, whilst in Sind there is distinct evidence that the sea covered the greater portion, and very probably the whole, of the country as late as the Miocene epoch.*

§ 2. *Zoological Relations between India and Africa.*—The curious points of connexion between the existing fauna of India and that of Africa and the Mascarene islands bear out the idea of India having formed in past times a portion of a great tropical continent. There also seems a probability, as might have been anticipated, that at different geological periods the distribution of land in this continental area varied, and that different portions were in union with each other. Leaving aside the remarkable evidence afforded by the Mesozoic (and Upper Palæozoic?) floras, amongst which identical species have been found in Australia, Southern Africa, and India, there appear to have been three distinct Tertiary and recent migrations of African types into India, or perhaps it would be more correct to say, that animals having affinities with those now inhabiting Africa have entered India in three different groups, two of which are older immigrants than the other. The first consists of the types common to the Malay countries, India, and Africa, which form a very large proportion of the fauna: such as certain monkeys and lemurs, the *Tragulidæ, Viverra, Herpestes, Manis,* and *Nectarinidæ, Dicruridæ, Oriolidæ, Pittidæ, Bucerotidæ, Ploceinæ, Megalaiminæ,* &c., &c., &c., *Varanidæ, Agamidæ,* &c.† As a rule the African and Indian genera are distinct, but exceptions occur, as in *Viverra, Herpestes, Manis, Zosterops, Varanus,* &c. Many of these forms extend to Australia.

The second group consists of forms common to India and Africa but not found east of the Bay of Bengal nor yet in Arabia or Persia, such as *Antilopidæ* (exclusive of *Gazella*), *Mellivora, Chicquera, Sypheotides (= Lissotis),*

* Records Geol. Surv. Ind. IX, p. 15.

† See for fuller details 'Africa-Indien' by A. v. Pelzeln in Verh. Zool.-Bot. Ges. Wien, 1875, p. 33.

Rhinoptilus, the family *Cyclostomidæ*, &c. With many of these the genera are different in India and Africa, though less frequently than in the first case, or, which is more to the purpose (for genera are often artificial, and depend upon human fancy quite as much as natural laws), the amount of divergence is less. The third group comprises forms which are found in Northern Africa Arabia, Persia, and India, but which do not extend to the Malay countries, such as *Hyæna striata*, *Canis aureus*, *Felis leo*, *F. jubata*, *F. chaus*, *Gazella*, *Gerbillus*, *Pterocles*, *Pyrrhulauda*, *Cursorius*, *Saxicola*, &c. In this case the genera and very often the species are identical. Many of the forms are also found in the neighbouring portions of the boreal or palæarctic region, and their number diminishes in India itself to the eastward and southward, whilst but few are found in forest. The forms belonging to this category appear to be recent immigrants.

§ 3. *The Indo-gangetic Plain between India and the adjoining regions of Asia.*—Thus both from geological and zoological evidence we have reason to conclude that the union of the Indian Peninsula with Central and South-western Asia is of comparatively late date, and it becomes a question of great interest to ascertain so far as possible the evidence of their own condition in the later geological epochs afforded by the tracts of flat country intervening between the peninsular area and the surrounding regions. These tracts consist chiefly of the great plains through which the Ganges and Indus flow to the sea, and the surface is covered to so great a depth by alluvial deposits from those rivers and their tributaries that very few traces can be found of the geological history of the country. It has been assumed by some writers that this great plain remained part of the sea long after the Himalayas had been elevated. This is not impossible, but so far as the Gangetic area is concerned I fail to see that there is evidence in favour of the view; and I think the idea is mainly due to the Pliocene Sevalik deposits having frequently been considered marine, whilst it is more probable that they are really of freshwater and probably subaërial origin, for not a single marine organism has been detected in them, whilst freshwater shells have been found in them in places. Even without entering into the question as to whether the whole Indo-gangetic plain has been covered by the sea in late geological times, the question arises whether the Indus plain, in which we have the latest evidence of marine life, has been thus covered. This is a speculation of Mr. Andrew Murray, proposed to account for the presence of a dolphin in the Indus and Ganges, and for the difference of the species inhabiting each.*

* Geographical Distribution of Mammals, p. 214. Mr. Murray's theory is briefly the following. The dolphin inhabited an arm of the sea which became a lake through the rise of land, and which was gradually rendered fresh by streams falling into it and cutting their way to the sea, first in the direction of the Ganges, secondly through

During a recent traverse of the desert, I have tried to find evidence of its condition in late geological times, and although the result is mainly negative, some facts appear to point to a recent condition of things when the sea did flow some distance up the Indus valley. At the same time I have not met with any evidence in favour of the view that the great plain of the desert has recently emerged from the sea. The route followed was from the Indus near Sehwan, viâ Umarkot in the Thar and Parkar district of Sind, to Bálmír, and thence to Jodhpúr in Rájpútana, returning from Jodhpúr, viâ Jaysalmír, to Rohrí on the Indus.

§ 4. *Physical Characters of the Desert. Botany and Zoology.*—It is as well before entering further into the subject to point out the chief peculiarities of the Great Desert. The term conveys an imperfect idea, because the tract of country is neither barren nor uninhabited; it is covered with shrubs and bushes in general, and in places small trees are found; moreover, although the population is thin, villages are scattered throughout, and immense herds of camels, cattle, sheep, and goats are kept and pastured. The desert is, in fact, a great sandy tract entirely destitute of streams of water, and with but few hills of rock, and a large portion of the surface consists of sand-hills of considerable height and is known locally as Thar (Thurr). When rain falls, crops of bájri (*Holcus spica*) are raised. When rains fail, the population lives principally on the milk of cattle and on imported grain.

Throughout the sandy tracts the vegetation* consists mainly of four plants known as *Phog* (Sindhí *Tob) (Calligonum polygonoides)*, *Bhúi* (Sindhí *Bahúsa) (Aerva Javanica)*, *Lána (Anabasis multiflora)*, and *Mart*, a coarse grass growing in tufts. *Lána*, although very common in some places, is rare or wanting throughout large tracts. *Phog* and *Bhúi* are peculiar to the sand-hills themselves; *Mart*, besides abounding on the sand-hills, covers the large sandy plains, which in many parts extend for miles. It is a coarse grass with a hard woody stem, and appears to be one of the principal plants eaten by cattle and horses. Another common plant on the sand-hills is *Kíp (Orthanthera viminea)*. Between the sand-hills *Madár (Calotropis procera)*, Pilú (Sindhi *Kabar* or *jár) (Salvadora Persica)*, *Kejri (Acacia rupestris ?)*, *Kiril (Capparis aphylla)*, *Ber (Zizyphus jujuba)*, and a few other plants are com-

the Indus after the Ganges had been cut off from the lake by another rise of land. He considers that by this means a marine dolphin has become converted into *Platanista* and then the animal has been transferred to the second river after being cut off from the first. The question of the origin of *Platanista* it is unnecessary to discuss; the migration of the original form from one river to the other has probably been due to some of the tributary streams, such as the Satlej or Jamna, being transferred from one drainage-area to the other. This would be effected by a very trifling change of level.

* I am indebted to Dr. King for the identification of these plants; of some, as *Mart*, I unfortunately did not take specimens.

monly found. After rain it is said that numerous herbs spring up, and a grass called *Brút (? Centhrus biflorus)*, the spiny seeds of which have a most unpleasant habit of attaching themselves to one's clothes like burs. These seeds, divested of their spiny covering, are used for food, and are made into a kind of bread.

As might be anticipated, the desert fauna is poor, and in the sandy tracts is entirely confined to animals which never require water. Hyænas are met with in the more hilly parts but not, I think, amongst the sand-hills; wolves *(Canis pallipes)* and jackals are more common. The only carnivorous animal, however, which is universally found, is the desert fox *(Vulpes leucopus)*; *V. Bengalensis* is also met with, but less abundantly. The caracal *(Lynx caracal)* is said to be common, but the only wild cat I saw was, I believe, *Felis torquata*, and I never succeeded in shooting one. None of the larger carnivora are found, though a leopard may occasionally straggle across to the hills of Bálmír or Jaysalmír. The mammal of the desert *par excellence* is the desert jerboa-rat *(Gerbillus Hurrianæ*)*, which exists in almost incredible numbers, the whole surface of the sand-hills being dotted over with the entrances to its burrows. Over thousands of square miles, the number of burrows probably exceeds on an average one to every square yard. There can scarcely be a doubt that this little animal—which is a pretty little creature of a greyish tawny colour, with rather long hind legs, a rounded head, and a long hairy tail—would in most countries furnish an important item of food, for it is purely herbivorous, living chiefly on seeds and roots. Besides furnishing food to the foxes and wild cats, this rat is the prey of buzzards and of many of the other raptorial birds. No other rodent is found in the sand-hills; I did not even see a hare, though the Sind representative of the genus *(Lepus Dayanus)* is common in the hilly tracts, whilst the only ungulate found in the Thar is the Indian gazelle *(Gazella Bennetti)*.

Thus it may be said that the only common mammals of the sand-hills are the fox, gerbil, and gazelle, and all these, I believe, can live without drinking. I am certain that the two latter never drink. The birds are more numerous. The common falcon is *F. jugger*, but I believe I saw *F. sacer* also. *Aquila fulvescens* abounds in places and I met with *Circaëtus gallicus* occasionally. But the most common raptores are the desert buzzard *(Buteo ferox)* and kestrils. Vultures, Neophrons, and kites are chiefly seen about villages. Owls are not common: I twice came across flocks of the short-eared owl *(Otus brachyotus)*, and I occasionally found *Athene Brahma* and once *Scops Brucei*.

The bee-eater *(Merops viridis)* is found generally distributed. Swallows are occasionally seen; swifts *(Cypselus affinis)* are very local as usual. Goat-

* *G. erythrourus*, Gray, *apud* Jerdon, but true *G. erythrurus* is a different species, Zool. Persia, p. 70.

suckers are extremely rare. Shrikes are represented by *Lanius lahtora*, which is common and the only species noticed amongst the sand-hills. *Dicrurus albirictus*, the common king-crow, is found everywhere, and two bulbuls *(Otocompsa leucotis* and *Pycnonotus pusillus)* are occasionally met with, the latter, contrary to what might have been expected, inhabiting the sand-hills quite as often as the former, if indeed it be not the commoner form. The striated babbler *(Chatorhea caudata)* is very abundant everywhere. *Franklinia Buchanani* is not uncommon. *Drymæca gracilis* is rare. *Sylvia curruca* is frequently seen, but both *S. Jerdoni* and *S. nana* are of exceptional occurrence. The *Phylloscopi* are of course very rare in this treeless region. The common *Saxicola* is *S. picata* throughout the whole desert ; *S. deserti* is not rare, but *S. isabellina*, so abundant in parts of Sind, keeps as usual to the more fertile tracts. I saw *S. chrysopygia* occasionally, and it was more common about the middle of March, when like other *Saxicolæ* it was migrating to the north. *S. opistholeuca* and *S. morio* I only noticed about Jodhpúr or between that town and Jaysalmír. *Pratincola Indica* (v. *rubicola)* was occasionally seen even amongst the sand-hills, *P. caprata* only in the more fertile tracts. *Thamnobia Cambayensis* was generally met with throughout the region. A stray *Motacilla alba* or *Budytes melanocephalus* was now and then seen near wells, and the pipits were poorly represented by the occasional occurrence of *Anthus campestris* and *A. sordidus.**

Larks are more abundant and the commonest species by far is the finch-lark, *Pyrrhulauda melanauchen (P. affinis*, Blyth), the very existence of which in India was scarcely known until quite recently. I was surprised to find *Mirafra erythroptera* by no means uncommon in the Thar, although it is unknown in Sind. *Galerita cristata, Melanocorypha bimaculata*, and *Calandrella brachydactyla* are also found, the two latter in flocks. The first is common, the other two far from rare. *Passer indicus* occurs everywhere of course, though preferring the neighbourhood of cultivation. *Gymnoris flavicollis* is usually found where there are trees. I once or twice saw *Emberiza Huttoni*, but *E. striolata* is found on all rocky hills. *Munia Malabarica* is common. Ravens *(Corvus corax)* are seen everywhere, the two common crows *(C. Vaillanti* and *C. impudicus)* only about cultivation. *Pastor roseus* is occasionally common, even amongst the sand-hills, but the two forms of maina *(Acridotheres tristis* and *A. ginginianus)* are only seen about villages. Doves are represented by *Turtur Cambayensis* and *T. risorius*, common everywhere, whilst the common wild pigeon *(Columba intermedia)* breeds in all wells. On the sand-hills I saw no sand-grouse; they only occur where water is procurable, but they occasionally drink at wells : the only common species is *Pterocles exustus*, but *P. arena-*

* *A. Jerdoni*, Finsch, *A. griseo-rufescens*, Hume. I find Mr. Blyth was right in uniting the Indian bird with the African form.

rius and *P. Senegallus* are met with in places. The grey partridge *(Ortygornis Pondiceriana)* is found everywhere, whilst the cream-coloured courser *(Cursorius gallicus)* and the Indian bustard *(Eupodotis Edwardsi)* are pretty generally distributed.

The common birds in the Thar are *Falco jugger, Tinnunculus alaudarius, Buteo ferox, Merops viridis, Pycnonotus pusillus, Lanius lahtora, Dicrurus albirictus, Chatorhea caudata, Sylvia curruca, Saxicola picata, Thamnobia Cambayensis, Pyrrhulauda melanauchen, Galerita cristata, Passer Indicus, Munia Malabarica, Corvus corax, Turtur Cambayensis, T. risorius,* and *Ortygornis Pondiceriana.*

The only common reptiles are lizards and they appear for the most part to hibernate in the cold season. The most abundant is *Acanthodactylus Cantoris;* I also found *Agama agilis* very common between Jaysalmír and Rohri. In the same district peculiar vermiform tracks abounded of a small lizard which I have no doubt is *Sphenocephalus tridactylus*, but this animal is nocturnal and a burrower, and although I often searched for it, I never succeeded in finding it. On more rocky ground I found *Ophiops Jerdoni* and *Mesalina pardalis.* The only harmless snakes which I saw were forms of *Zamenis* and *Psammophis,* and the only venomous species was *Echis carinatus.* No tortoises were seen or heard of.

§ 5. *Distribution of the Sand-hills.*—The sand-hills have a somewhat peculiar distribution. They occupy a large tract in Eastern Sind, extending the whole length of the province, along the edge of the Indus alluvium. Here they are close together and form long ridges, running nearly north-east and south-west near Umarkot, and about north-north-east to south-south-west near Rohri.* In the southern portion of the desert, they are said by Sir B. Frere to run nearly east and west. They are much higher to the southward than to the north, but I saw none approaching the heights of 400 to 500 feet, said by Sir Bartle Frere to be common in parts of the desert.† The highest sand-hills which I observed near Umarkot, cannot, I think, have exceeded 200 feet, but I did not measure them, so I may be in error. This tract on the borders of Sind is the "Thar"—a name which is, in the country, restricted to the sand-hill region. From the Sind frontier to Bálmír, although there are many sand-hills, they are far from being as generally distributed as they are to the westward, whilst east of Bálmír they are, for some distance, only dotted over the surface, but they again become more general before reaching the Lúni river, and the hills, in this direction, appear to form part of a sand-hill tract which stretches to the northward

* The change in direction is shewn on the revenue survey map, on which the general course of the ridges is indicated.

† I was told that the highest sand-hills are found more to the southward between Umarkot and the Ran of Kachh.

or rather to north-north-east in the direction of Bikanír. The hills in this tract are not in such regular ridges as they are to the westward, but here also they appear to diminish in height and to become more scattered to the north. Between Jodhpúr and Pokarn this eastern belt of sand-hills is only about 40 miles broad. From some distance east of Pokarn to Jaysalmír, and again for 50 miles west of Jaysalmír, the country is an undulating sandy plain, but there are very few sand-hills. I have no personal knowledge of the desert north of Jaysalmír. Stripped of the sand-hills the country would be a vast plain, slightly elevated above the sea, and only broken by isolated hills to the southward, by the somewhat more numerous ranges near Bálmír, by low plateaux of sandstone towards Jodhpúr and Pokarn, and by terraces of Jurassic sandstone and limestone around Jaysalmír. The hilly regions are less sandy; occasionally even torrent-beds are found near the hills, but they are soon lost in the sand.

§ 6. *Evidence of subrecent Marine Action. Salt 'dhands.'*—It is impossible for any geologist to traverse this region without the suggestion forcing itself upon him that this may be an example of Professor Ramsay's planes of marine denudation. Such was my first impression. But I could only find one circumstance, the general saltness of the ground, in confirmation of this view. Every here and there throughout the desert is a smaller or larger plain of salt ground or "ran", which is said to become a shallow salt lake after heavy rain. From such places salt is sometimes extracted, but the quantity is small, and not more than might, very possibly, result from the gradual concentration of the salt distributed in small quantities throughout the soil. The water in the wells is very often brackish, but this is equally the case in countries which shew no trace of having been recently covered by sea water. There is, however, a very remarkable quantity of salt in two localities which I visited, and in one of them there is, I think, good evidence of the former neighbourhood of the sea.

To take the more important and the more interesting first. North of Umarkot the boundary of the Indus alluvium and of the Thar or sand-hill area is formed by a river known as the Narra or the Eastern Narra,* which derives its water from floods in Baháwalpúr and the Rohrí district of Sind, and has of late years been artificially supplied by a canal cut from the Indus at Rohrí. On the east of the Narra rise high ridges of sand with the usual NE to SW direction, and between these ridges are deep valleys filled with water and known as 'dhandhs.'† Some of these 'dhandhs' are said to be unfathomable;—and doubtless they are so by an ordinary pole

* The Sindhi form, I believe, of the common Hindi *Nala*, a river channel, ravine, or ditch.

† *Dhandh* in Sindhi is the equivalent of *jhíl* in Hindi and is applied to any pool of water or to a marsh.

or bamboo, the only instrument likely to have been used in general for sounding. Sir Bartle Frere says that he has been assured that the depth of one has been measured and found to be 70 feet.* This shows of course considerable depression below the level of the Indus alluvial plain, for the Narra, which must of course be a little below the average level of the plain, supplies, or used to supply, the water for the 'dhandhs' in its immediate neighbourhood.

There are, however, a large number of small lakes isolated amongst the sand-hills and not in communication with the 'dhandhs' fed by the Narra, and these isolated lakes are all salt; those farthest from the Narra being apparently the most saline, and some being so concentrated that salt crystallizes on their margins. All these salt 'dhandhs' appeared to me to be at a lower level than the freshwater lakes, and this view was confirmed by my finding that small streams fed by springs amongst the sand-hills enter in many cases at the western edge of the salt 'dhandhs', and that where, as not unfrequently happens, there are more than one 'dhandh' in the same hollow, a stream often flows from the western pool to that lying more to the eastward. Now the water can only be derived by percolation through the sand from the freshwater 'dhands' to the westward: it is true that springs often rise from the margin of the latter, and that these springs are sometimes above the surface of the lakes, but they are usually below, and if higher they are not so far above as in the case of the salt lakes to the eastward, on the edge of which I found springs issuing from the ground 15 or 20 feet above the water.† It is a natural conclusion that the original surface of the ground at this spot was not higher than the bottom of the 'dhandhs' are now, that it was much lower than the present alluvium of the Indus, and that the Indus plain has been raised to its present height by the accumulated silt deposited from the river since the 'dhandhs' have been cut off and isolated by the sand-hills.

§ 7. *Marine Mollusk living in salt lakes.*—One more observation gave the clue to the original conditions of the ground. I found in some of the salt lakes in which the water, although very salt, was rather less so than that of the ocean, a living mollusk which has been identified by Mr. Nevill with *Potamides (Pirenella) Layardi*, H. Ad. This species inhabits the salt water of back-waters or lagoons and harbours: it is not found to the best of my belief on open coasts, nor yet in the brackish water inside the mouths of rivers, and although, like most other forms of *Potamides*, it is rather

* J. R. G. S. XL, p. 189.

† The springs on the edges of the freshwater dhandhs are doubtless due to the water which percolates into the sand when the dhandhs are at their highest level from floods brought down by the Narra.

estuarine than truly marine, its habitat is always in water nearly if not quite as salt as the sea. The specimens which I obtained are precisely like those now living on the coast of India. Several cases are known of marine animals (chiefly vertebrata or crustacea, however) found living in freshwater, and apparently descended without change from ancestors which inhabited the same tract when it was part of the sea, but it is rarer to meet with a marine or estuarine mollusk living on unchanged in inland salt lakes without an outlet, at a distance of 150 miles from the sea and of 100 miles from the nearest point to which the tide reaches. The conclusion to be drawn from the existence of this mollusk is unmistakeable: it must have inhabited the tract now occupied by the sand-hills and their enclosed 'dhandhs' when that tract was in direct communication with the sea, and probably when it formed part of a large lagoon.

§ 8. *Former existence of an Inlet of the Sea in Eastern Sind. The Ran of Kachh.*—Two further conclusions follow as corollaries, the first that the saltness of the soil or subsoil is due to this tract of country having been the bed of the sea, or of an inlet, the second that the sand-hills must have been formed on the margin of the lagoon, and that probably the lagoon was partly filled up and isolated by accumulations of blown sand.

About 100 miles to the south of Umarkot lies the Ran of Kachh, an immense salt plain covered by salt water when the sea, driven up into it by the south-west monsoon, ponds back the more or less brackish water brought down by the Lúni and the few streams which run in from the hills of Kachh. Various theories have been proposed to account for the Ran. It is commonly considered an area of upheaval, a raised sea bottom. This is the view taken by Captain Grant and by my friend Mr. Wynne*, although both speak also of its silting up. I had an opportunity of seeing a portion of the Ran in 1863 and I wrote of it (in 1867†) "I am disposed to consider (the Ran) the bed of an inlet of the sea filled up by the accumulation of detritus brought down by the rivers. It is just at present in the debateable state, water part of the year, land another part . . . . of course the whole may be an area of depression, but further proofs of this are necessary than the fact of a small portion having been sunk and another part raised by the earthquake of 1819."

It must be borne in mind that there is evidence of slight elevation at several places on the coast of Western India; such has been noticed in Sind, Káthiáwád, and on the borders of the Ran itself, and the area of the Ran has doubtless shared in the general rise. So far I agree with other observers; but if I understand them correctly, I infer that they rather regard the Ran as an area of special upheaval, and in this I cannot concur.

* Memoirs Geol. Surv. India, IX, pp. 21, 28.

† Ibid. VI, p. 31.

The probability is that Kachh was originally an island*, and the Ran a vast inlet of the sea, which gradually became shallow, just as other inlets on the coast of India, *e. g.* Bombay harbour, are gradually being filled up by silt deposited from rivers, aided, in the case of the Ran, by blown sand and also by the gradual elevation of the whole area, and (which is the most important point in the present discussion) that this inlet extended into the region now forming Eastern Sind to a distance of at least 100 miles and probably much further. I have no precise information as to the distance to which the salt 'dhandhs' extend to the northward, but they are certainly found in the Khairpúr territory, and I find one marked on the map in Rohri, whilst there is a tract of country between Jaysalmír and Rohri in which wells of freshwater are excessively scarce and local. West of Umarkot the wells are brackish for about 35 miles; further east than this rock is found in the wells and the water is sweet. The spot where the change takes place may mark the limit of the former inlet.

§ 9. *The Lúni Basin.*—We thus have proof that an arm of the sea ran for a considerable distance up the Indus valley in very late geological times, although it is not yet manifest how far it extended, and the question arises whether there is any reason for inferring the former existence of the sea in any other part of the desert area. I have already mentioned a second locality which I had an opportunity of examining, and where salt is found in large quantities. This is near a town called Panchbhadra, a short distance north of the Lúni river and about 45 miles south-west of Jodhpúr. Here salt is largely manufactured in a slightly depressed tract of country, which may formerly have been the bed of a salt lake, but is now surrounded and partly covered by drift sand. Salt must abound throughout the lower course of the Lúni, for the water of the stream in the dry season is very strongly impregnated. It is not merely brackish, it is decidedly salt. The fall of the river is said to be very small, but of this I had no means of judging personally. If it be the fact, the river's course below Panchbhadra may very possibly have been an arm of the sea in recent times.

It is impossible to avoid speculating on the origin of the salt in the Sámbhar lake being also connected with the former extension of the sea.

§ 10. *Want of evidence of Marine Denudation elsewhere in the Desert.*—Apart from the evidence afforded by the abundance of salt and the remarkable existence of a marine shell in the salt 'dhandhs' of the Thar, I searched in vain for evidence of recent marine action in the desert. The general flatness of the area may be due to marine denudation, but it may also be due to the extreme flatness of the rocks and the absence of disturbance.

* The distribution of the Tertiary rocks in Kachh is quite consistent with the view that this tract formed an island in Eocene times, when we know that the Indus valley, Balúchistán, and Southern Persia were beneath the sea.

Except near Bálmír, where there are some craggy hills of ancient formations, and where the sandstones of Mesozoic age resting upon the older rocks dip at high angles, the sedimentary beds found preserve almost perfect horizontality. The low cliffs of sandstone near Jodhpúr, and those of sandstone and limestone near Jaysalmír, are palpably scarps of subaërial denudation, for they correspond precisely, over miles of country, to the outcrop of the harder beds ; nowhere is a characteristic marine cliff, cutting through different strata, to be met with, nor is there any evidence of marine action, so far as I can see, around the isolated hills of Bálmír. Whilst therefore there is a probability that the sea did extend up the Indus valley and a possibility that it may have stretched up the Lúni basin, and from one side or the other have reached the Sámbhar salt lake, there is no evidence that it covered in recent times the central area of the desert about Bálmír and Jaysalmír.

§ 11. *Nature and Origin of the Sand-hills.*—I have already described the general distribution of the sand-hills, and I have said that I am unable to coincide with Sir Bartle Frere's views as to their origin. He compares them to the ridges of rock found in Sind, and suggests that they may be due to earthquake-action. He points out that the Allah Bund, which is known to have been caused by an earthquake, is " a perfect outlying specimen of a typical Thar sand billow of moderate height", and he discusses the mode of formation of sand-ridges by the wind and gives his reasons for believing that the ridges of the Thar are not due to wind-action. To some of these reasons I shall revert presently. Meantime, I think Sir B. Frere has overlooked some phenomena of sand-hill formation. At the same time none of the works I have been able to consult throw any light upon the parallel sand-ridges of the Thar, of which I confess I am unable to offer a satisfactory explanation. I think, however, that there can be no doubt that all are due to wind-action alone, and I will give my reasons after describing the peculiarities presented.

The sand consists chiefly of small grains of quartz, mixed with felspar and hornblend in smaller proportions, other minerals only occasionally occurring. The grains are mostly rounded, precisely as in the sand of rivers or of the coast, and they are tolerably uniform in size.

I have already mentioned that the sand-hills form long ridges, with a very uniform general direction, along the edge of the Indus alluvium, where they are highest, and where the country is completely covered by sand, and that they are less regular in their direction more to the eastward. But there is one character which they preserve in both localities, though it is much more strongly marked to the eastward, and this is a tendency to terminate abruptly with a steep face towards the north-east. The long north-east to south-west ridges have as nearly as possible the same slope on both

sides, but they often end in a higher point at their north-eastern extremities. The scattered hills east of Bálmír are always highest to the north-east and slope away very gradually to the south-west. The sand-hills as a rule are evidently of very great antiquity; they often shew evidence of denudation from the action of rain, and sometimes they are worn into ravines several feet in depth. When it is considered how small the desert rainfall is (11·8 inches in the year at Umarkot, 18 at Nagar Parkar, but much less in the central portion of the desert, and especially towards Jaysalmír), it is evident that a long series of years must be required for ravines even a foot in depth to be cut in the sand, since it is only in exceptionally heavy showers that any water can run off so porous a surface. At the north-eastern termination of these sand-hills, however, there is frequently found a quantity of sand which is shewn to be newly deposited by its surface being ripple-marked, by the absence of holes made by burrowing animals, and by the stems of bushes being partially buried. Lastly, from the north-east corner of most of the high hills near Bálmír a long ridge of sand runs out, evidently deposited by the wind under the lee of the hill.

Now there is one point to which it is necessary to advert before going further. I must apologize for mentioning a fact doubtless familiar to most of my readers, but although familiar with it on a small scale, I did not clearly understand its application when I first went into the desert, and in consequence I was for some time greatly puzzled by the phenomena presented by the sand-hills; I think, too, that it has been overlooked by Sir Bartle Frere, and that this accounts in part for his doubting the efficacy of the wind in producing the sand-hills of the Thar. On the possibility that it may not be universally familiar I will venture to call attention to it.

When the wind blows over any surface composed of particles which can be moved independently, it forms waves or ridges more or less at right angles to its direction, with a long low slope to windward and a steeper slope to leeward. Something similar is seen in sand-banks formed by rivers and must be well-known to all who have navigated any Indian river in the dry season. In descending the stream the depth of water every here and there will be found to diminish gradually up to a certain point, which is part of a shoal stretching more or less across the channel; below this the water becomes suddenly deep. Here again the long gradual slope is on the side from which the current runs, the steep slope in the direction towards which the river is flowing.

This phenomenon on the small scale must be familiar to every one, as it may be seen on sand or dust wherever the wind blows over it. The long slope to windward is variable, the steeper slope to leeward is that assumed naturally by a talus of the material forming the ripples. The sand is driven up the longer windward slope by the wind and

falls over the crest of the ridge.* Sand-dunes along the coast are rendered irregular in shape by accidents of the surface on which they have accumulated, but the laws of their formation are precisely similar to those of the ripples, and the same principles govern the formation of inland sand-hills. The latter are often even more irregular in form than the sand-dunes of the coast, because they are not formed along one general line, but depend on the accidental accumulation of sand wherever the character of the surface is favourable. In every case, however, the direction of the wind to which the drifting of the sand is due is marked by the two slopes in opposite directions, the long slope to windward, the steep slope to leeward. The sand-hills near Bálmír are evidently due to the transport of sand by a south-west wind.

I made many enquiries in the desert country as to the prevailing wind. From all whom I asked I received one answer, that during the hot season, May, June, and July, a strong wind blows steadily from the south-west. Even in March, on two occasions, a violent wind sprang up in the afternoon from that quarter, and the air was so thick with sand that at times it was impossible to see more than a dozen yards. There is no meteorological station fairly within the desert region, but the registers of wind-direction at Karáchí and Dísá shew a great prevalence of south-westerly winds in the hotter months of the year, the general direction being more westerly at Dísá than at Karáchí; up to April the general direction at Dísá is north of west. At other periods of the year the winds are light, and during the months of January, February, and March, when I was in the desert, light breezes from the north or south prevailed alternately, but with the exception of the south-west winds already mentioned, they were quite insufficient to move the sands.

I do not think that further evidence is needed to prove that the formation of sand-hills throughout the eastern part of the desert is due to the south-west winds of the hot season, but there is a much greater difficulty as regards the long north-east to south-west ridges of the Thar. That they are also due to the prevailing winds is apparent from the circumstance (already mentioned) of their frequently terminating in a high bluff with a steep slope to the north-east, but still their general direction, identical with that of the prevailing wind, is rather difficult of explanation, because ridges

* The formation of sand-dunes will be found discussed in any elementary treatise on Physical Geography or Geology. The following works contain excellent descriptions of the phenomena exhibited by blown sand:—Lyell, Principles, Vol. I, p. 516; De la Beche, Geological Observer, p. 59; Jukes, Manual, p. 154; Naumann, Geognosie, II, p. 1170; Ansted, Physical Geography, p. 467; and especially Marsh, 'Man and Nature,' pp. 471-483, and Reclus, 'The Ocean' (English translation), I, pp. 198-214. I am indebted to my brother Mr. H. F. Blanford for the latter references.

are usually produced at right angles to the wind's direction.* Parallel rows of sand-dunes along a coast are frequently due to the regular sea-breeze, and, as may be seen on the east coast of India, there are often several such rows one behind the other, but they exhibit the usual evidence of their origin by having a long slope towards the sea and a short steep slope landwards. I think it quite possible that the sand-hills of Umarkot and Eastern Sind generally may be of such antiquity as to date from a period when the relative distribution of sea and land in the region was different from what it now is, and that to so great an extent as to completely modify the prevailing winds, and I have even been induced to speculate on the possibility of the existent parallel ridges of sand-hills marking successive coast-lines as the sea receded from the face of the country. This hypothesis, however, would render it necessary to suppose that the Indus valley was a land area whilst the present desert was part of the sea, and that the western coast-line of the sea with a general north-east to south-west direction gradually receded towards the south-east; or, *vice versâ,* that the Indus valley was sea, and the country to the south-east dry land. But I can hardly conceive that such gigantic changes as this would involve could have taken place without completely changing the original form of the sand-hills, and it is evident that the ridges in the region of the salt 'dhandhs' must be posterior in date to the time when their present site was part of an inlet of the sea, and not anterior to it. Moreover, had the sand-hills been formed along a coast-line, or even inland at right angles to the prevailing wind, they would, here and there at all events, have preserved some traces of their original slopes shewing the direction of the wind which produced them. But there is nothing of the kind to be found. I looked most carefully for some evidence of a steeper slope on one side than on the other, but without success, and I found double ridges having a trough-like hollow along the crest, with the slopes on both sides of the hollow, as well as those on both sides of the main ridge, equally steep. For such ridges I am quite unable to account by the effect of a wind blowing at right angles to their direction. If they were formed by one great sand-wave overtaking another, one side of the depression between the crests of the two waves must be much steeper than the other, and although this would be slightly modified by time, it could not be entirely obliterated and yet leave the general form of the waves so little altered as they now appear.

I am obliged therefore to reject the theory that these parallel ridges are due to a wind acting at right angles to their direction. I cannot accept Sir Bartle Frere's view that they are due to earthquake-action. The ridges

* Naumann, however, in his 'Geognosie' (edition of 1854, Vol. 11, p. 1171), says—"The sand-hills themselves are in every country extended in length in one direction which agrees with the direction of the prevailing wind."

consist of the characteristic blown sand; the Allah Bund, to which Sir Bartle compares them, is only 20 feet high and of great breadth, and consists of the silt which forms the Ran*, whilst even the fact of the elevation being due to the earthquake appears not clearly established. The only alternative conclusion as to the origin of the Thar sand-ridges is that they were due to the wind blowing in the same direction as that in which they lie. Sir B. Frere objects to their origin by the wind that they are higher than any known ridges of blown sand, but I find it recorded that in the Landes of Gascony many dunes exceed the elevation of 225 feet and one attains the height of 391 feet, whilst on the west coast of Africa hills of blown sand are said to be found in the neighbourhood of Cape Verde no less than 600 feet high.†

This view of the sand-ridges having been produced by winds blowing in the same direction is supported by the frequent occurrence (already mentioned) of abrupt terminations of the ridges at their north-eastern extremities. It should be borne in mind that the ridges, although extending for considerable distances, often for some miles, do end or coalesce every here and there, and that there is not any regularity in the size of the valleys that intervene; some of these valleys being of considerable breadth, others narrow. As a rule, the intervening valleys do not exceed half a mile in breadth where the ridges are tolerably regular, and in many places the hollows are, as a rule, much narrower. Not unfrequently a tract is found where ridge and valley succeed each other with the greatest regularity for a few miles, the valleys being from twice to three times as broad as the ridges.

I am not able to explain the mode of formation of these parallel ridges satisfactorily to myself. I can suggest three modes in which they may have been formed, aud I think it possible that all may have acted at times.

The first is the mode of formation from a ridge transverse to the direction of the wind. When such a ridge is driven forward, the ends advance more rapidly than the centre, and a crescent is formed, the convex side to windward. This on a small scale is a common and familiar phenomenon, and is mentioned and explained in all text-books. I can conceive it probable that, with constant supplies of sand, the ends of the crescent may continue to be produced until they form parallel ridges. But I must say I have not seen this change in progress in the sand-hills of the desert.

The second suggestion is that the sand is carried along in lines by the wind. I once came across a tract in which a sand-ridge appeared to be in process of formation. This was about 50 miles W. N. W. of Jaysalmír, at the spot where the Thar or sand-hill country was entered from the undula-

* See Wynne, Geology of Kutch, Memoirs Geological Survey of India, IX, p. 40.

† Naumann, Geognosie; Reclus, L 'Ocean, ll. c. &c. The latter writer gives Ritter as his authority.

ting sandy plain. Over a breadth of about a quarter of a mile, and right and left, in the direction of the wind, as far as the eye could distinguish, the surface was covered with sand in small newly formed hillocks, mostly of crescentic form and about 5 to 10 feet high. The direction of the wind was shewn to be from S. 35 E., this being at right angles to the lines of ripples, and to the chords of the crescentic arcs formed by the hillocks ; and the general direction of the sand-ridges immediately to the westward was the same. Many of these sand-ridges were so regular that it was difficult to conceive that they could have been formed otherwise than in long lines. But I do not quite understand how the wind can thus form them. There is a great difference between forming a line of hillocks and uniting them into one continuous ridge.

The third suggestion is that the tract of country along the edge of the Indus alluvium was originally covered at least as deep as the height of the present sand-hills by sand arranged more or less in ridges at right angles to the prevailing south-west wind, and that the valleys between the present sand-hills are the result of wind-denudation, their contents having been swept away and the intervening ridges left. The abrupt terminations of the ridges mark the former leeward slope of the sand-hills. On the whole, I think this last theory is the most probable of the three.

The sand, it is true, accumulates in long ridges behind any obstacle, and, when a ridge is once found, it will tend to be prolonged to leeward. But no obstacle exists of sufficient size to account for the commencement of a ridge 100 to 200 feet high.

§ 12. *Source of the Sand.*—There is yet one point which demands notice and that is the source of the sand. Rounded sand-grains are rarely produced in any quantity by simple subaërial disintegration, except in the case of the degradation of a sandstone, and in the present instance there is no sandstone area to windward. All the sand may safely be assumed to be derived from river-channels or the sea coast.

Part of the sand may be derived from the bed of the Indus, and probably a large portion of the sand-hills of Rohrí are supplied from this source. But it is difficult to conceive that all the sand-hills of Thar and Párkar, Mallání, Jaysalmír, &c., can have derived their sand from the Indus, to say nothing of those of Jodhpúr, Bikanír, &c.

Some of the sand also may be derived from the present coast-line. But all the sand-hills are at a distance from the coast, and it is difficult to conceive that all the sand has been blown across the delta of the Indus and the Ran of Kachh to reach the region where it so greatly abounds. Had all the sand which is spread over the plains of western Rájpútána been blown across the Ran, the latter would surely have been converted into a sandy desert long since.

The only remaining conclusion is that the sands are derived from a former coast-line, which no longer exists. The greatest accumulations of sand are found in the lowest portions of the desert, along the edge of the Indus alluvium, and in the basin of the Lúní, and it has already been pointed out that, precisely in these localities, the presence of salt in considerable quantities renders the inference probable that arms of the sea extended into them at a comparatively recent date. Thus both the distribution of salt and the prevalence of sand-hills point to the same conclusions, and it is reasonable to infer that the sea, which, at no remote period, covered the Ran of Kachh, extended for a considerable distance both to the north up the Indus valley and to the north-east up the basin of the Lúni.

In most countries in which sand is blown from river-beds or the sea-coast, it is either blown into other river-channels or it is swept into them by rain. Once in the river-channels it is again carried onward to the sea. There are small sand-hills in abundance in the Indus alluvial plain, but they attain no great size because the sand is always swept sooner or later into some stream. The peculiarity of the desert is the absence of any streams—a want due primarily to the small rainfall, but intensified of course by the accumulation of sand and the consequently porous nature of the soil. To the eastward in Rájpútána, as the rainfall increases, streams become more numerous and sand-hills diminish in number. In short, the sands of the Indian desert appear to have been blown from an old coast-line in the Indus valley, along the northern edge of the Ran of Kachh, and probably in the Lúni valley, by the strong south-west wind, and they remain spread over the country for the want of streams to carry them back to the sea.

§ 13. *Conclusions.*—The conclusions to which I have been led by the facts narrated in the previous paper may be thus briefly recapitulated.

1. Within very recent geological times the Ran of Kachh was part of an inlet of the sea, which certainly extended for a considerable distance up the eastern edge of the area now occupied by the Indus alluvium, and perhaps occupied the whole alluvial area of the Indus valley: it also in all probability covered a considerable tract in the Lúni basin.

2. The central portion of the desert about Jaysalmír and Bálmír was not covered by the sea, but formed either an island or a promontory. As the northern part of the desert, towards Baháwalpúr and Bikanír, has not been examined, it is uncertain whether there is any evidence of its having been covered by the sea or not.

3. The sand of the desert is mainly derived from the old sea-coast, and its transport into the interior of the country is due to the south-west wind.

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X.—*A Sketch of the Vegetation of the Nicobar Islands.*

By S. Kurz.

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(With Plates XII and XIII.)

The Nicobars form a link in the chain of islands that stretches up from Sumatra to the Arracan Yomah, and they are in all probability the remnants of a mountain-range that connected Sumatra (and more especially the Nias islands, where the same sandstone prevails as that of the Andamans and Arracan) and Arracan at a time when the sea covered the vast alluvial plains of the Ganges and the Indus, thus rendering Hindustan an island subsequently to its probable connection with Africa.

Geologically, the Nicobars are divisible into two groups, the southern and the northern. The former comprises Great and Little Nicobar with the adjacent islets and Katchall. It is characterised by the predominance of calcareous sandstones (Brown-coal formation). The northern group includes Nankowry, Kamorta, Trinkut,* Teressa, Tillangchong, Karnicobar, and the small islands near them. Alluvial deposits and plutonic rocks are the conspicuous feature here. This geological division admirably coincides with the general botanical appearance of the respective islands.† While the islands of the southern

* Trinkut is not entirely composed of raised coral-reefs as Dr. Hochstetter has stated, but has grass-heaths in the centre, the presence of polycistina-clay being thus indicated. It is a very flat island, barely 50 feet. above sea-level in the interior.

† This sketch relates to the islands of Katchall and Kamorta only, sickness having prevented me from extending my explorations to the other islands. A review of the more interesting peculiarities of the Nicobar vegetation is to be found in Trimen's Journal of Botany, 1875, p. 321 sqq.

group are forest-clad from the bottom to the top, the forests on the northern group are restricted to the plutonic rocks and to the slopes and dells of the older alluvium, while the hilly plateaux and ridges are covered with park-like grass-heaths.

Botanically, we have to consider the following rocks and soils as influential :—

1. Plutonic and metamorphic rocks, which crop out only in a few localities and are very subordinate.

2. Calcareous sandstones, which cover by far the greater part of the southern group.

3. Raised coral-reefs much broken up and intermingled with calcareous sand and vegetable mould.

4. Calcareous sea-sand, or blown sand, consisting of minute rounded fragments of shells and corals.

5. Polycistina-clay, which covers the greater part of the area on the northern group. It is very light and siliceous, and remarkable for the absence of alkalies. Locally it is ferruginous and of a red colour, and in this case usually accompanied by fossil sea-weeds.

6. Marine silty clay at the debouchures of rivers, more especially in sheltered bays and shoals.

Dr. Rink and Dr. Hochstetter have already been struck by the close coincidence of the vegetation with the underlying rocks on these islands; and although a close examination of this relation revealed to me many important exceptions, we must be guided in all phytogeographical matters not only by the consideration of climatic influence but as much also by that of the influence of soil.

As the climate is a tropical moist one, identical with that of most Malay islands, and the elevation of the hills too small to affect vegetation, the influence of the soil naturally becomes more conspicuous and marked. Owing to the uniformly damp climate deciduous forests have ceased at this latitude, although deciduous trees are not unfrequently interspersed, especially in sunny localities. Evergreen trees thus form the bulk of the forests, and even the beach-forests, sunny forests growing on calcareous sand, are studded with evergreens, so that the deciduous trees become quite subordinate. I have distinguished the following kinds of vegetative combinations on these islands:—1. Mangrove Forests. 2. Beach Forests. 3. Tropical Forests. 4. Grass-heaths. 5. Marine Vegetation.

Cultivation is little represented, being restricted to small patches of cleared land usually at some distance inland from the villages.

1. Mangrove Forests.

The mangrove-forests of all tropical Asia are so uniform, not only in external aspect but also in their botanical character, that it is hardly

necessary to enumerate their constituents. They occupy, as already indicated, chiefly the silty debouchures of the rivers, and are most fully developed in the quiet bays, and more especially along the channel that separates Kamorta from Nankowry. *Rhizophora mucronata* and *Bruguiera mucronata* form usually the bulk of these forests on the Nicobars. Owing to the smallness of the rivers, and to the consequent narrowness of river-alluvium, the variety of these forests distinguished by me as 'tidal forests' is not developed, although localities are met with, on the banks raised above tidal mark, which partake of the same character.

2. Beach Forests.

The beach-forests, or dune-forests, as Dr. Junghuhn, in his excellent account of the vegetation of Java, has more appropriately called them, are restricted to the beaches of fine calcareous sand which stretch along the shores where the hills do not interfere. The islands being in a rising condition, the formation of beaches is favoured to a greater degree than at the Andamans and elsewhere, and some of them extend as far as half a mile inwards. They necessarily form narrow, often crescent-shaped strips, and abruptly terminate where the raised coral-reefs commence. The trees here stand apart and are light-loving ones, and of these the cocoa-nut-palm forms the principal constituent, no doubt much encouraged in its dense growth by cultivation. The outskirts of these dunes are usually marked by a few long-creeping plants, such as *Ipomoea pes-caprae, Vigna lutea, Ischaemum muticum, Thouarea sarmentosa* locally on Katchall, *Ipomoea littoralis*, etc. To these succeed a number of small trees or shrubs, which appear from the sea like a dense hedge; these are chiefly the glaucous-looking *Scaevola Koenigii, Pandanus odoratissimus, Tournefortia argentea* (especially on the southern group), *Paritium tiliaceum, Sophora tomentosa* locally, *Crinum Asiaticum* with a plantain-like trunk up to 3 feet high by nearly a foot in thickness, and others. Then follow *Calophyllum inophyllum, Hernandia peltata, Glochidion calocarpum, Eugenia Javanica, Sterculia mollis, Premna integrifolia, Erythrina Indica, Pongamia glabra, Desmodium umbellatum, Macaranga Tanarius, Heritiera littoralis, Cynometra bijuga, Ficus retusa, Thespesia populnea, Peltophorum ferrugineum* scantily, *Cycas Rumphii, Vitex negundo, Atalantia macrophylla, Claoxylon molle* and *C. longifolium, Afzelia bijuga, Barringtonia speciosa, Odina wodier, Ficus hispida, Terminalia catappa, Guettarda speciosa, Dracaena linearifolia* in abundance, *Excoecaria Agallocha, Semecarpus heterophyllus, Barringtonia racemosa, Ochrosia salubris, Cerbera Odallam, Briedelia glauca*, and others. The shrubby vegetation consists chiefly of *Morinda bracteata, Callicarpa longifolia, Cordia subcordata, Breynia racemosa, Securinega obovata, Allophylus Cobbe, Tabernaemontana Nicobarica, Leea sambucina* and, locally,

L. grandifolia, *Pluchea Indica*, *Clerodendrum inerme*, intermingled with a young growth of trees and climbers, such as *Cyclea peltata*, *Canavalia virosa*, *Caesalpinia nuga* and *C. Bonduc*, *Wedelia scandens*, *Ipomoea Turpethum*, *Entada scandens*, *Anodendron*, *Ipomoea campanulata*, here and there a rattan, *Colubrina Asiatica*, *Derris scandens* and *D. uliginosa*, several species of *Vitis*, *Flagellaria Indica*, *Stenochlaena scandens*, *Modecca Nicobarica*, etc. On the ground chiefly grow *Ischaemum muticum* in abundance, *Centotheca lappacea*, *Oplismenus compositus*, *Remirea maritima* locally, *Euphorbia atoto*, *Aerva lanata*, *Eranthemum succifolium* very commonly, *Ophiorrhiza mungos* chiefly from the base of the cocoa-nut-palm, *Kyllingia monocephala*, the white-spiked variety of *Cyperus umbellatus*, and a number of widely distributed weeds. *Cassytha filiformis* often quite covers the shrubbery, while the trunks of the trees are seen to be clothed with *Dischidia Bengalensis* or *D. nummularia*, *Pothos scandens*, or with some *Hoya*. Orchids are here numerous on the branches of the higher trees, *Dendrobium crumenatum* and *Luisia* particularly so. The stems of the trees are covered with lichens, especially those of the cocoa-nut-palms, which are literally clothed by them and by a few acrocarpous mosses (chiefly *Octoblepharum*, *Macromitrium*), while a few ferns (amongst them *Davallia parallela* and *D. heterophylla*, *Polypodium phymatodes*, *P. quercifolium*, and *P. adnascens*) also find a favourable station between the rugged scars of this same palm.

As these dunes are the principal seat of the villages, there spring up, around the huts of the natives and often far away from them, a number of trees, shrubs, and weeds, which are with difficulty distinguished from the surrounding indigenous vegetation. Most of them can hardly be said to have been planted but rather to have sprung up of themselves. Such are *Citrus Hystrix* and *C. nobilis*, *Bixa Orellana*, *Carica papaya*, *Ricinus communis*, *Psidium guava*, *Triphasia trifoliolata*, *Capsicum frutescens*, *Solanum melongena*, *Lagenaria vulgaris*, etc.; also such weeds as *Ageratum conyzoides*, *Vernonia cinerea*, *Digitaria*, *Eragrostis*, *Solanum nigrum*, *Datura*, *Amarantus viridis;* and sometimes *A. Gangeticus*, *Sida acuta*, *Urena lobata*, *Scoparia dulcis*, *Cassia occidentalis*, *Blumea lacera*, *Ocymum sanctum*, *Euphorbia pilulifera*, *Paspalum conjugatum*, *Eleusine Indica*, *Gynandropsis pentaphylla*, etc., etc.

3. Tropical Forests.

The tropical forests occupy a large (say, about one-third of the whole) area of the islands of the northern group, while they are so greatly developed in the southern group as to leave only a small fraction for the other forests (mangrove- and beach-forests). I am obliged to divide them into two groups, namely, (i). *Coral-reef Forests*, and (ii). *True Tropical Forests*, growing on elevated ground.

(i). *Coral-reef Forests.*—These forests occupy, as the name indicates, the raised coral-reefs which usually stretch out behind the dunes, and are sometimes of comparatively large extent. The substratum being calcareous and of a very permeable nature, these differ greatly in their constituents from the true tropical forests. They form masses of pretty low evergreen trees overshadowed only by a few species of lofty trees up to 120 feet high, which, however, are pretty numerous in individuals. Such big trees are *Eugenia occlusa, Alstonia spectabilis, Ficus Indica* and *F. retusa, Artocarpus pomiformis, Saccopetalum Horsfieldii, Garcinia speciosa,* and a few others not recognised by me. The smaller trees comprise chiefly *Orophea Katschallica* in abundance, *Glycosmis insularis, Aglaia argentea* and *A. Andamanica, Amoora ganggo, Cupania Jackiana, Olax imbricata, Apodytes Andamanica, Ixora Pavetta, I. weberæfolia* in abundance, and *I. brunnescens, Webera densiflora, Petunga Roxburghii, Morinda bracteata, Alchornea, Alsophila albo-setacea* here and there (usually clothed with mosses and *Trichomanes Filicula* and *T. muscoides*), *Mallotus acuminatus* and *M. muricatus* in abundance, and several others. Of the shrubs are especially conspicuous *Psychotria Nicobarica, P. tylophora,* and *P. Andamanica, Ixora Kurziana. Areca Catechu* is here so plentiful as to appear wild, but is, I believe, only planted or self-sown. *Pandanus Leram* usually accompanies the betel-nut palm. Of climbers, I observed chiefly *Griffithia curvata, Dinochloa Andamanica, Antitaxis calocarpa, Vitis lanceolaria* and other species, *Alangium Sundanum, Stenochlæna scandens, Freycinetia* in abundance, often accompanied by the fleshy *Pellionia procridifolia.* The soil-cover is scanty and chiefly consists of *Adenostema viscosum, Aglaonema simplex, Cyperus moestus;* and a number of ferns, such as *Davallia speluncae, Vittaria elongata, Antrophium callaefolium, Asplenium macrophyllum,* and *Nephrolepis acuta* are observed as epiphytes, together with a number of orchids, especially *Saccolabium obliquum.* The coral-rocks are densely covered with a tamariscine *Hypnum,* and long garlands of *Neckera Lepineana* and of *Hepaticae* depend from the branches and trunks where the jungle is not too dark.

Where depressions occur in these upheaved coral-lands, fresh water collects and forms pools and swamps,* which dry up more or less during the driest months on these islands (March and April). These are filled then to several feet in depth with black vegetable mould, which is so soft that one sinks into it up to the knees. They cause a sort of swamp-forest

* Dr. Rink has proposed a theory to explain the origin of these swamps in the raised coral-reefs. Similar jungle-swamps, often of large extent, occur in all Malay tropical forests on metamorphic as well as on alluvial formations, and are in my opinion only the result of rains, which drain into the depressions and carry quantities of vegetable mould into them until they silt up.

represented by *Ficus Indica* and *F. retusa*, the plank-like compressed roots of which often extend far into it and afford the only firm footing; while on other islands *Pandanus Leram* takes possession of them. Little else grows on this black marshy ground except here and there a *Polygonum* or a *Helminthostachys*. *Lemna paucicostata* is often frequent here, and a *Najas* too was observed. These jungle-swamps are the natural reservoirs of drinking water for the Nicobarese, who simply dig a hole into the mould, wherein the water collects.

(ii). *True Tropical Forests.*—These forests grow on different substrata, and those growing on the calcareous sandstone of Katchall and of the other islands of the southern group will have to be distinguished from those which grow on polycistina-clay and on plutonic rocks. Having, however, for several reasons been prevented from exploring these forests on Katchall, I can only testify to the truth of Dr. Rink's statement that those of them which grow on the shady side of the ridges are, like those that grow on plutonic rocks, the loftiest forests on the islands and hence most difficult to explore; the south-west exposures, however, of these ridges on Katchall are covered by a stunted forest wherein the trees are not crowded, and which, to judge from the colour of rounded crowns, must be very poor in species.

The Andamanese bullet-wood tree (*Mimusops littoralis*) is frequent along the coast of Katchall, and I met with fallen trunks of it which measured 80 feet clear stem by 10 to 12 ft. in girth.

I will, therefore, restrict my remarks solely to the tropical forests as they are represented on the polycistina-clay of Kamorta. This island is formed chiefly of this clay, while only the extreme S. W. part (hills about 1,000 feet high) consists of plutonic rocks. The forests, however, do not cover the whole of this formation, but abruptly terminate just below the top of the hilly plateaux, although two broad strips of tropical forest cross the whole island. The trees at the upper limit rather suddenly become stunted, as if unfavourable exposure had checked their growth and given them the appearance of having reached the limit of tree-growth. The cause of the abrupt demarcation of these tropical forests and the grass-heaths on the very same substratum remains a mystery to me. Above all the trees, however high, a palm towers majestically, and in such quantity as to form, as it were, a palm-forest above the other trees. This is *Areca augusta*. The lofty or large trees (many of which, however, become quite stunted at the outskirts of the forest bordering the grass-heaths) are chiefly the following:—*Artocarpus peduncularis* and *A. pomiformis*, *Radermachera Lobbii*, *Eugenia occlusa*, *Sterculia campanulata*, *Symplocos leiostachya*, *Ternstroemia macrocarpa*, *Trichospermum Javanicum*, *Garcinia cornea*, *Orania Nicobarica* in abundance, *Ficus Indica*, *F. chrysocarpa*, and *F. retusa*, *Gonystylus Miquelianus*, *Sapindus montanus*, *Terminalia* sp. near

T. catappa, *Dillenia pilosa*, *Calophyllum spectabile*, *Elæocarpus*, *Albizzia stipulata* plentifully, *Gardenia resinifera*, *Nauclea excelsa*, *Alstonia macrophylla*, *Cryptocarya ferrea*, *Litsaea foliosa*. Amongst the smaller trees the following are conspicuous :—*Arthrophyllum Blumeanum*, *Ixora weberaefolia*, *Polyphragmon flavescens*, *Maesa ramentacea*, *Cinnamomum obtusifolium*, *Barringtonia racemosa*, *Sideroxylon attenuatum*, *Fagraea racemosa*, *Myristica corticosa*, *Antidesma puncticulatum* and *A. persimile*, *Aporosa microstachya*, *Briedelia tomentosa*, *Artocarpus integrifolia* locally, *Villebrunea sylvatica*, *Macaranga gigantea*, *Croton argyratum*, *Ryparia caesia*, *Pittosporum ferrugineum*, *Sterculia hyposticta*, *Evodia Roxburghii*, *Dracaena Griffithii*, *Parastemon urophyllus*, *Buchanania platyneura*, *Albizzia bubalina* and *A. fasciculata*, *Rhodamnia trinervis*, *Mussaenda macrophylla*, *Eugenia claviflora*, *Garcinia calycina*, *Dracaena linearifolia*, *Glycosmis insularis*, *Anacolosa puberula*, *Apodytes Andamanica*, *Ochna Andamanica*, *Leea sambucina*, *Erioglossum rubiginosum*, *Gnetum gnemon*, *Champereya gnetocarpa*, and, locally, *Pandanus Leram*. *Areca Catechu* here grows quite wild, especially in the lower and more marshy localities. *Alsophila albosetacea* is often met with, but always in few individuals only. The most frequent climbers are *Dinochloa Andamanica*, *Zizyphus subquinquenervis*, *Vitis lanceolata*, *V. pedata*, and *V. repens*, *Derris thyrsiflora*, *Heptapleurum ellipticum*, *Dioscorea glabra*, *Smilax polyacantha*, *Uncaria pilosa*, *Jasminum acuminatissimum*, *Anodendron paniculatum*, *Erycibe paniculata*, *Elaeagnus arborea*; *Gnetum macropodum*, *Calamus Andamanicus* and several other rattans, *Freycinetia insignis* and another species ; besides, *Uvaria micrantha*, *Salacia* and *Hippocratea*, *Griffithia curvata*, *Blumea riparia*, *Embelia microcalyx*, *Parsonsia spiralis*, *Ipomoea vitifolia* and *I. Nicobarica*, *Stenochlaena scandens* and *Lygodium circinatum*. *Pothos scandens* and *Gymnopetalum heterophyllum* often creep up the trunks of the trees. Shrubbery is little developed, and as everywhere else, represented by the slender treelets already enumerated, young tree-growth, and rattans, especially a *Zalacca (?)* Of herbs are chiefly seen *Lasianthus laevicaulis*, *Hedyotis rigida* and *H. costata*, *Homalonema aromaticum* plentifully, *Aglaonema simplex*, *Amomum Fenzlii* plentifully, and some other *Scitamineae* which were in leaf only, *Maranta dichotoma*, *Adenostemma viscosum*, *Blumea myriocephala*, *Amaracarpus pubescens* (restricted to the plutonic rocks), *Corymbis disticha* here and there, and several grasses and sedges, like *Cyperus moestus*, *Hypolytrum latifolium*, *Scleria lithosperma* and *S. Sumatrensis*, *Oplismenus compositus*, *Panicum filipes*, *Kyllingia monocephala*, *Centotheca lappacea*, and, in more open localities, *Thysanolaena acarifera*. Ferns are plentiful but apparently not much varied as regard species ; those observed most frequently are *Nephrodium molle* and other species, *Nephrolepis acuta*, *Lindsaea tenera*, *Davallia speluncae*, and *Selaginella caudata*. On stems

and branches of trees grow chiefly *Asplenium nidus* and *A. macrophyllum*, *Vittaria elongata*, and a number of orchids, like *Oberonia*, *Trichoglottis quadricornuta* frequently, *Phalaenopsis cornu-cervi*, *Pholidota imbricata*, and *Saccolabium obliquum*. Parasites were not observed, but *Henslowia erythrocarpa* was once met with. Owing to the darkness, mosses and liver-mosses are not well-developed here, but along the rocky courses of rivulets patches of *Fissidens* and *Hypna* occur.

Where clearings take place in these forests, *Scleriae* chiefly occupy the terrain, with other grasses, amongst which *Hibiscus Abelmoschus* is often observed.

4. Grass-heaths.

The grass-heaths, as they have been called by Dr. Diedrichsen, occupy the hillocky plateaux of most of the islands of the northern group, and are physiologically equivalent to the "low forests" of Pegu, more especially with that variety of them in which the trees are more scattered. They form park-like grass-lands,* which are made up chiefly of *Scleriae*, *Eragrostis Zeylanica*, *Eriachne Chinensis*, *Rhynchospora Wallichii*, *Heteropogon contortus*, several species of *Fimbristylis*, *Imperata arundinacea*, *Spodiopogon* (very hairy) and the hairy *Sorghum muticum* (these two grasses grow chiefly on the outskirts of the tropical forests and at the bottom of the dells, where they attain a height of 5 to 6 feet), *Dimeria* locally, *Chrysopogon aciculatus*, *Eragrostis unioloides*, *Digitaria*, and *Cyperus polystachyus*. Of other plants associate chiefly *Gleichenia dichotoma*, *Lycopodium curvatum*, *Pachystoma senile*, which here has always rose-coloured flowers often colouring whole tracts red, *Eulophia graminea*, *Urena lobata*, *Triumfetta rhomboidea*, *Desmodium polycarpum* scantily and *D. heterophyllum*, *Pycnospora nervosa*, *Uraria lagopodioides*, *Lindsaea lanceolata*, *Hedyotis approximata*, *H. Wallichii*, and *H. graminicola*, *Evolvulus linifolius* scantily, *Euphorbia parviflora*, and some others. At the bottom of the numerous dells where rivulets not more than from 2 to 3 feet in breadth have cut courses from 4 to 5 ft. deep, the grasses naturally grow more luxuriantly and entirely hide the water. Such places are usually more or less swampy and in this case a great number of other grasses and plants appear, such as *Cyperus vulgaris*, *C. Haspan*, *C. Iria*, *C. pilosus*, and *C. dilutus*, *Fimbristylis miliacea*, *F. complanata*, *F. diphylla*, *Fuirena umbellata*, *Rhynchospora aurea*, *Scleria laevis*, *S. Sumatrensis*, and a white-fruited form of the last (these prevailing), *Pas-*

* The northern parts of Karnicobar are for a great part covered by *Saccharum spontaneum*, and it seems that part of the grass-heaths of the northern part of Kamorta (where the wild buffaloes occur) is also covered by this grass. At least I am informed that coarse grass, cutting like a knife, occurs between Tring and Enaka. Those grass-lands which I visited above Tring and of the northernmost part of Kamorta are all the same as those of the southern part.

palum scrobiculatum and *P. flexuosum*, *Panicum colonum*, *Isachne miliacea* var. *humilis*, *Arundo Roxburghii* (usually occupying whole tracts where it occurs), *Ceratopteris thalictroides*, *Acrostichum aureum* here and there, *Blechnum orientale*, *Eriocaulon longifolium*, *Smithia sensitiva*, *Jussiæa villosa*, *Adenostema viscosum* var. *elatum*, *Hygrophila salicifolia*, *Limnophila hirsuta*, *Gonostegia hirta*, *Pouzolzia Indica*, and several others. *Lygodium scandens* and *L. pinnatifidum* are occasionally met with in the long grass. Small as these valleys are and often separated only by a low rounded ridge, they have often certain species entirely peculiar to themselves and recurring nowhere else. Such plants as I found only once or twice (but then often in quantity) are *Polygala leptalea*, *Crotalaria calycina* and *C. sericea*, *Blumea flava*, *Utricularia diandra*, *Dysophylla auricularia*, *Colocasia virosa* in large quantity, along with *Nephrodium propinquum*, *Isachne myosotis* and another species (of the habit of *Panicum miliare*), *Polypodium longissimum*, *Helminthostachys Zeylanica*, *Fimbristylis diphylla* var. *villosa*, *F. nutans*, and *F. globulosa*, *Rhynchospora filicaulis*, *Scleria lateriflora*, *Cyrtopera fusca*, *Thrixspermum amplexicaule*, *Blyxa Roxburghii*, and *Aneilema ensifolium*.

The shrubbery, more developed at the outskirts of the tropical forests, is scanty on these heaths and very poor in species, consisting chiefly of *Pittosporum ferrugineum*, *Polyphragmon flavescens*, and *Eugenia claviflora* (these three reduced to mere shrubs), *Melastoma Malabathricum* and a small procumbent form of it, *Helicteres obtusa*, *Rubus Moluccanus*, *Blumea balsamifera* (locally), *Vitex negundo* (rare), and an impoverished condition of *Gmelina asiatica*.

The trees are very scattered, and none of them exceed 30 feet in height. The bulk consists of *Fagraea racemosa*, *Aporosa glabrifolia*, *Antidesma Ghaesembilla*, and *Pandanus odoratissimus*, the last more along the swampy valleys and in them. *Casuarina equisetifolia* is seen, especially on the northern part of Kamorta. A stiff *Dendrobium*, a few ferns, as *Polypodium adnascens*, *Davallia solida*, *D. parallela*, etc., as also *Dischidia nummularia* and *D. Bengalensis*, are the chief, if not the only, epiphytes. Here and there one meets with small patches which have evidently been under cultivation at some time, as is indicated by the cucurbits (*Benincasa cerifera*, *Lagenaria vulgaris*, *Cucumis utilissima*, *Momordica* and *Citrullus*) that are still to be seen growing on them.

5. Marine Vegetation.

Katchall and Kamorta, the two islands which I had an opportunity of exploring, though separated from one another only by a narrow but deep channel about 8 miles broad, present very different shores: the former is encircled by fringing coral-reefs, while the latter is nearly free from them; the large amount of muddy deposit formed by the action of the sea upon

the soft polycistina-clay of which the island is formed, being unfavourable to the growth of corals. As a consequence the marine vegetation of Kamorta is very poor, and the algæ chiefly found on its shores are *Zonaria* (small), *Hypoglossum*, *Bostrychia*, *Gongroceras*, and such like forms; the numerous seaweeds found washed ashore having possibly all been brought from the submarine coral-reefs of Katchall and other islands. Of phanerogams, *Enhalus acoroides* is the only representative: this is a plant which grows chiefly in shallow waters at the debouchures of rivers, where it often forms whole submarine meadows, apparently little caring for the mud which is carried into the sea, and which often encrusts the whole plant. If we turn to Katchall, the marine vegetation assumes quite a different aspect; not only are small *Sargassa*, *Zonaria* in large specimens, and other melanosperms richly represented, but some of the coral-reefs are so densely covered with numerous olive-brown, green (*Ulva*), and red seaweeds, that it is often difficult to disentangle the different species. Such is especially the case along the western shores of the island. On the submerged coral-reefs are found also the marine phanerogams *Halophila ovalis* and a *Cymodocea*, together with another plant having a very close resemblance to *Enhalus* but much smaller. Fragments of the *Cymodocea* can be seen floating in quantities; which indicates the presence of turtles.

In drawing up the appended enumeration of the plants hitherto found on these islands, I have to express my sincere thanks to Hofrath Dr. Fenzl, Director of the Vienna Museum, who with rare liberality has not only forwarded to me the collections made by Mr. Jelinek during the stay of the Austrian frigate 'Novara' at these islands, but also presented to me a complete set of the duplicates. He has also entrusted to me Mr. Jelinek's MS. Journal, by means of which I have been enabled to note the localities and native names. These vernacular names I have given in the German mode of spelling adopted by Jelinek, as I thought it not advisable to alter them. During Mr. A. O. Hume's cruise round the Nicobars in 1873, a small collection of plants (chiefly leaf-specimens) was made by two native garden-collectors. Some of these proved new to the flora of the Nicobars or furnished additional localities; they are all marked in the following list with "g. c." (garden-collectors).

A number of the plants included in the following list are taken from Dr. Diedrichsen's list. These are marked "*teste* D." between brackets.

Enumeration of the Plants of the Nicobar Islands.

DILLENIACEÆ.

1. Dillenia pilosa, Kurz in Journ. As. Soc. Beng. 1872, 292 and 1874, 46, vix Roxburgh.—Not unfrequent in the tropical forests of Kamorta.

N. B. The leaves of the Nicobar tree are 1 to 1½, in saplings up to 2, feet long, more broadly decurrent to the very base, and while young half-stem-clasping. I formerly identified this tree with Roxburgh's, but I now entertain great doubts as to the correctness of my identification, having ascertained that the insular species is a southern form, which is unlikely to extend so far north as Assam.

ANONACEÆ.

2. Uvaria micrantha, Hf. and Th.—Not unfrequent in the tropical forests of Kamorta.

N. B. *Uvaria cordata*, Wall. Cat. 6486, is still retained as a synonym of *U. macrophylla* in the Ind. Flora, although Miquel and I have pointed out that it is the typical Blumean *U. ovalifolia.* Hf. and Th. now refer some Bornean and Phillipine specimens to *U. ovalifolia*, Bl. I have not seen the Kew *U. ovalifolia.*—*Goniothalamus Malayanus*, Hf. and Th. is certainly identical with *G. Slingerlandtii*, Scheff. (not *G. Stingelandtii* as the authors of the Indian Flora call it).—*Melodorum prismaticum* Hf. and Th. and *M. rufum* (*Pyramidanthe rufa*, Miq.) are two very different species; the former has the leaves and the simply minutely granular carpels quite glabrous, the stalk very short, and the peduncles longer; while the latter has the leaves more or less tawny pubescent beneath, the carpels strongly rugose-verrucose, minutely tawny puberulous, and the stalk about two-thirds of an inch long.

3. Unona desmos, Dun.—Katchall (g. c.).

4. Polyalthia lateriflora, Kurz in Journ. As. Soc. Beng. 1874, 52.—In the forests of the Nicobars (Stoliczka).

5. P. sp.—Not rare in the tropical forests of Kamorta. It is a small tree, with leaves similar to those of *P. Sumatrana* but broader and otherwise different. Flowers and fruits unknown.

6. Popowia parvifolia, Kurz in Trim. Journ. Bot. 1875, 324.—Kamorta, in tropical forests; also Karnicobar (Novara 153; Jelinek 42—*tabeleroi*, inc.) and Trice and Track (g. c).

N. B. The leaves of the Novara specimens are much larger than in mine and the berries 3—1-seeded.

7. Anona muricata, L.—Cultivated near the villages of Kamorta and Nankowry, and probably elsewhere.

8. OROPHEA KATSCHALLICA, Kurz in Trim. Journ. Bot. 1875, 323.—A common shrub or small tree, forming the chief undergrowth in the coral-reef-forests of the eastern parts of Katchall.—It comes nearest to *O. Brandisii.*

9. SACCOPETALUM HORSFIELDII, Benn.—Scarce in the coral-reef-forests of the western coast (Modsha tapoo) of Katchall.

N. B. *Bergsmia Sumatrana,* Miq. Suppl. Fl. Sumatr. 389, = *Kingstonia nervosa,* Hf. and Th.

MENISPERMACEÆ.

10. ANAMIRTA COCCULUS, W. A.—Common in the tropical forests of Kamorta.

11. COCCULUS INCANUS, Coleb.—Frequent in cleared lands, shrubberies, and along the borders of jungles, etc., of Kamorta and Katchall; Nankowry (Novara 151; Jelinek 130—*mungdrum,* inc.) Trice and Track (Novara 152; Jelinek 176—*thé,* inc.)

12. CYCLEA PELTATA, Hf. and Th., var. PENDULINA (*C. pendulina,* Miers Contr. III. 243).—Frequent in the beach-forests of Kamorta and Katchall; entering also the coral-reef-forests.

N. B. Dr. Diedrichsen also enumerates *Stephania* as a Nicobarese plant.

13. ANTITAXIS CALOCARPA, Kurz in Trim. Journ. Bot. 1875, 324.—Not unfrequent in the swamp-forests of Katchall.

NYMPHÆACEÆ.

14. NYMPHÆA sp.—Nicobars (*teste* D.).

CRUCIFERÆ.

*15. BRASSICA JUNCEA, L.—Apparently cultivated at Malacca, Nankowry.

N. B. *Cheiranthus parryoides,* Hf. and T. And. Ind. Fl. I. 132, = *Parrya nudicaulis,* Regel in Radde Ost. Sibir. 176 (*P. macrocarpa,* R. Br.; Hf. Ind. Fl. I. 131).

CAPPARIDEÆ.

16. CLEOME VISCOSA, L.—Nicobars (*teste* D.).

17. GYNANDROPSIS PENTAPHYLLA, DC.—A weed around the huts of the natives in the beach-forests of Kamorta and Katchall.

18. CRATÆVA MACROCARPA, Kurz in Trim. Journ. Bot. 1874, 195 and 1875, 324.—Rare in the coral-reef-forests of the western coast of Katchall.

N. B. *Capparis Hasseltii* in Journ. As. Soc. Beng. 1874, 70 is not Miquel's plant. It differs from it by the short (2—3 lin. long) gynophore of the one-seeded berry. My earlier name (*C. ambigua*) must therefore be restored.

VIOLACEÆ.

19. Alsodeia Bengalensis, Wall.—Rare in the tropical forests of Kamorta.

20. Alsodeia sp. Leaves only.—Katchall (g. c.).

N. B. *Viola Hookeri*, Thoms. in Hf. Ind. Fl. I. 183, is apparently the same as *V. glaucescens*, Oudem. in Miq. Ann. Mus. Lugd. Bat. III. 74.—All the localities (except the Kakhyen-hills) of *V. serpens* in my Contr. Burm. Flora in Journ. As. Soc. Beng. 1874, 72 must be referred to *V. Thomsoni*, Oudem. in Miq., l. c.

BIXINEÆ.

21. Bixa Orellana, L.—Like wild in the beach-forests of Katchall and Kamorta; entering also the coral-reef-forests; Karnicobar (Jelinek—*oak*, inc.)

22. Ryparia cæsia, Bl.—Rather frequent in the tropical forests of Kamorta.

The trees while young but already fruiting freely, have the leaves very large (up to one and a half feet long) and proportionally of a thinner texture and a laxer net-venation, which gives them a very different appearance.

N. B. *Roydsia floribunda*, Hf. Ind. Fl. I. 409, in note, = *R. Phillipinensis*, Turcz. in Bull. Nat. Mosc. 1854. 329 (Cuming 541).

PITTOSPOREÆ.

23. Pittosporum ferrugineum, Ait. (*P. Javanicum*, Bl. ?).—Common in the tropical forests of Kamorta; freely entering the grass-heaths, where it becomes reduced to a mere shrub.

POLYGALEÆ.

24. Polygala telephioides, Willd.—Rather frequent on the grass-heaths of Kamorta but easily overlooked. Having now more carefully examined this species in nature, I consider it a good one. The flowers are whitish, but the keel upwards and the crest are of a beautiful lazuli-blue.

25. Polygala leptalea, DC.—Here and there amongst the grass along rivulets in the grass-heaths of Kamorta.

N. B. *Xanthophyllum paniculatum*, Miq. Suppl. Fl. Sum. I. 393, must be cut out from the synonyms to *X. flavescens* in Hf. Ind. Fl. I. 209 and in my Contr. Burm. Flora in Journ. As. Soc. Beng. 1874, 79; it differs greatly in the tomentose ovary.

PORTULACACEÆ.

26. PORTULACA OLERACEA, L.—A weed around the huts of the natives on the beaches of Kamorta and Katchall.

GUTTIFERÆ.

27. GARCINIA SPECIOSA, Wall.—Not unfrequent in the coral-reef-forests of Katchall; also Nankowry (Novara 167; Jelinek 138—*pajua*, inc.)

28. GARCINIA CORNEA, Linn.—Common in the tropical forests of Kamorta; also Nankowry (Novara 168; Jelinek 131—*pajua*, inc.)

29. GARCINIA CALYCINA, Kurz in Trim. Journ. Bót. 1875, 324.—Common in the tropical forests of Kamorta.

N. B. Dr. Hooker (Journ. Linn. Soc. XIV. 485) wishes to correct a supposed error of mine in regard to No. 155 of Maingay's Collections, which I declared (*in litteris*) to be identical with *G. rostrata (Discostigma rostratum*, Hassk.). He points out, *inter alia*, a different *androecium*. Both the specimens of the above Maingayan No. in H. B. C. are females, and hence an *androecium* is here out of the question. The male flowers of *G. rostrata* are up to date still unknown,* and I cannot understand how Teysmann could have sent male specimens to Dr. Hooker, as it is a fact that the only tree in the Buitenzorg garden, upon which Hasskarl based his species, is a female one. Hence I must suspect that Dr. Hooker received *G. Merguiensis* from Teysmann, a male tree of which is cultivated in those gardens. Under these circumstances and after re-examination of the Maingayan specimens I hold to opinion expressed.

30. GARCINIA (XANTHOCHYMUS) JELINEKII, nov. sp.

Arborea, glabra; folia oblonga ad elliptico-oblonga, basi acuminata, petiolo gracili circiter semipollicari suffulta, apiculata, 5—7 poll. longa, tenuiter coriacea, glabra, nervis lateralibus tenuibus subconfertis intra marginem anastomozantibus percursa; paniculæ fructigeræ cymiformes, glabræ, breviter pedunculatæ, petiolo circiter duplo longiores, terminales et laterales; sepala sub fructu 5, semilineam circiter longa, ovata, acuta, glabra; baccæ obovatæ v. sub-globoso-obovoideæ, cerasi majoris magnitudine, apice cum stigmate minuto impressæ, læves, 2—1-spermæ; semina 6—7 lin. longa, compressooblonga, lævia. Tillangchong (Novara 169; Jelinek 106).

31. CALOPHYLLUM INOPHYLLUM, L.—Frequent in the beach-forests all along the coast of Kamorta and Katchall; also Karnicobar (Novara 166;

* Miquel, however, seems to have known the male flowers of it, although all he says about them is that they are panicled.

Jelinek 39—*eheang* or *pi-jang*, inc.); *puyan*, inc. Katch.—Mr. Jelinek remarks that the Nicobarese build their canoes of this tree.*

32. Calophyllum spectabile, Willd.—Not unfrequent in the tropical forests of Kamorta.

33. Calophyllum Wallichianum, Planch. and Trian.—Not rare in the tropical forests of Kamorta.

TERNSTRŒMIACEÆ.

34. Ternstrœmia Penangiana, Chois.—Not unfrequent in the tropical-forests of Kamorta. A tree 70 to 80 feet high, of which I once met with a stunted individual in the grass-heaths.

N. B. *Gordonia excelsa*, Dyer in Hf. Ind. Fl. I. 291 (not of Blume) var. *a. pubescens*, Dyer, l. c., = *G. dipterosperma* (*Dipterospermæ* sp. Griff. Not. IV. 564). Blume's tree differs so much from the above in the long peduncles, large hirsute capsules, and in the texture and pubescence of the leaves, that it is difficult to understand how it could have come to be identified with the Khasi and Sikkim tree. *G. Singaporeana*, Wall., = *G. anomala*, Spreng. Syst. III. 126; Hf. Ind. Fl. l. c. 292 (*Camellia axillaris*, Roxb. in Bot. Reg. 349). This species again is certainly different from Blume's *G. excelsa*, and greatly resembles *Laplacea integerrima*, Miq. It occurs also in Penang, where the late Dr. Stoliczka collected it. Dyer seems not to have read the description in the Bot. Register, but to have relied solely upon the reduced figure when he recognised in it a S. China species. *G. Maingayi*, Dyer, is the same as Miquel's *Laplacea subintegerrima*, which again hardly differs from *L. aromatica*. As Miquel has already pointed out, the distinguishing characters of *Gordonia* and *Laplacea* are not reliable, and in *Eurya*, for for example, the free or united styles are not even regarded as of specific value. *Kadsura pubescens*, Miq., is a very distinct species of *Actinidia*, allied to *A. callosa*, L. *Dilleniacea? nervosa*, Wall. Cat. 6635, from Singapore, = *Shorea sublacunosa*, Scheff.; *Shorea macroptera*, Dyer, = *Sh. lepidota*, Bl.; *Hopea micrantha*, Hf. = *H. Mengarawan*, Miq.

MALVACEÆ.

35. Sida carpinifolia, L., var. acuta (*S. acuta*, Burm.).—A common weed in the beach-forests and in cultivated spots. (Novara 160; Jelinek).

N. B. *Sida amoena*, Wall. Cat. 1848 from Ava, which Masters doubtfully refers to *Abutilon fruticosum*, Guill. and Perr., has 12 carpels and is simply a small form of *A. Indicum*, Don.

* I doubt this, for the Nicobarese cut the trees for their canoes far in the interior, while *Caloph. Inophyllum* is a shore tree. The timber of their boats more resembles that of *Artocarpus*.

36. Urena lobata, L.—A common weed in the beach-forests and in the grass-heaths of Kamorta and Katchall; also Karnicobar (Novara 162; Jelinek 46—*kassinyi*, inc.) and Pulu Milu (Novara, 161; Jelinek 188—*utschu*, inc.).

37. Hibiscus Abelmoschus, L.—Frequent in clearings and open shrubby spots in the tropical forests of Kamorta.

38. Hibiscus tiliaceus, L.—Common in the beach-forests of Kamorta and Katchall; on the first-named island it occurs also exceptionally in a few patches on the hills along the margin of the tropical forests; also Karnicobar (Novara 158 and 159; Jelinek 3—*taó kowa*, inc.); *imbon*, inc. Katch.

39. Thespesia populnea, Corr.—Common in the beach-forests, and generally along the whole coast of Kamorta and Katchall; also Karnicobar (Novara 125; Jelinek 75.—*matka*, inc.) and Tillangchong (Novara 126; Jelinek 89).

*40. Gossypium herbaceum, L.—Cultivated at Kamorta, and occasionally around habitations. Its growth on Kamorta (polycistina-clay) is very inferior; it should be tried on the coral-grounds of Katchall, etc., where it will thrive better.

STERCULIACEÆ.

41. Sterculia mollis, Wall.—Rather frequent in the beach-forests of Katchall; also Nankowry (Novara 165; Jelinek 145—*fó*, inc.).

N. B. I have now had an opportunity of ascertaining that the specimens of the *Sterculia* referred to *S. parviflora* in my Contrib. Burm. Fl. (Journ. As. Soc. Beng. 1874, 117, sub 10) are a variety of the above. The true *St. parviflora*, Roxb., occurs in the Ava and Sylhet hills, but Masters' Malayan specimens have nothing to do with Roxburgh's species.

42. Sterculia hypoSticta, Miq. Suppl. Fl. Sumatr. 399.—Common in the tropical forests of Kamorta. It is a treelet up to 20 ft. high, with stems of about an inch in thickness.

43. Sterculia longifolia, Vent. ?—In the tropical forests of Kamorta. Only leaves, hence the doubtful identification.

44. Sterculia campanulata, Wall. var. glabrifolia, leaves quite glabrous, cordate-rotundate. Common in the tropical forests of Kamorta and Katchall, and there one of the loftiest trees.

45. Heritera Tothila, Kurz in Journ. As. Soc. Beng. 1874, 118 (*H. littoralis*, Dry.). Common in the beach-forests of all the islands; Karnicobar (Novara 214; Jelinek 84—*kamtrad*, inc.).

46. Helicteres obtusa, Wall.—A most common meagre shrub on the grass-heaths of Kamorta.

47. Abroma augusta, L.—Nankowry (Novara 154; Jelinek 172—*komopoang*, inc.).

48. Visenia Indica, Houtt.—Rather frequent in the tropical forests of Kamorta; also Nankowry (Novara 168; Jelinek 168—*diam*, inc.).

N. B. *Pterospermum diversifolium*, Bl. (Hf. Ind. Fl. I, 367) is reduced by Miquel (Ill. Fl. Arch. Ind. 84) to a synonym of *P. acerifolium*, and he includes in this species *P. fuscum*, Korth also.—*Pt. Blumeanum*, Korth., (Kurz in Journ. As. Soc. Beng. 1874, 120) is identified by Miquel (l. c.) with *P. Javanicum*, Jungh. in Tydsch. Natuurk. Gesch. en Physiol. VII. 306 (Miq. Ill. Arch. Ind. 88). In Journ. As. Soc. Beng. 1874, 122, I have placed *Buettneria crenulata*, Wall. in Hf. Ind. Fl., amongst the doubtful species. I have since come across the specimens of Wallich's *B. crenulata*, which I see have been correctly placed by me in *B. aspera*, Coleb., from which it differs in no respect. But *B. echinata*, Wall. Cat. 1150, of which I have seen nothing but fragments, is a different plant, and I now believe that Masters drew up his description chiefly from this species, the name of which must be restored.

TILIACEÆ.

49. Grewia calophylla, Kurz.—Not unfrequent in the tropical forests of Kamorta.

N. B. *Grewia Miqueliana*, Kurz in Flora 1872, 398 (with which Maingay's No. 244. is identical), is really a distinct species from the above, differing not only in the characters already mentioned by me but also in having fruits only half the size.

50. Triumfetta rhomboidea, Jacq.—A narrow-leaved variety of this occurs here and there in the dry grass-heaths and around the huts of Kamorta.

N. B. *T. humifusa*, Hassk., = *T. procumbens*, Forst. *T. trilocularis*, Roxb., is more likely a form of *T. semitriloba*, L.

51. Trichospermum Javanicum, Bl.; Clos. in Ann. sc. nat. 4 ser. VIII, 265 (*Bixagrewia Nicobarica*, Kurz in Trim. Journ. Bot. 1875. 325. t. 169).—Not unfrequent in the tropical forests of Kamorta.

N. B. If Loureiro's *Thrixspermum* (Orchideæ), in a corrected form, obtains acceptance amongst botanists, as indeed Reichenbach fil. has already proposed, Asa Gray's *Diclidocarpus* will also supersede Blume's generic name. *Chartacalyx accrescens*, Mast. in Hf. Ind. Fl. I. 382, is in my opinion only a species of *Actinophora*. The difference in the calyx is not of generic value, and as regards the stalked ovary, we should bear in mind, that the ovary of *Actinophora* is globose and constricted at base, and hence that the character of the stalk is one of development only. *Pentace triptera*, Mast. is only a 3- or rarely 4-celled and -winged variety of *P. polyantha*, Hassk.

52. Elæocarpus floribundus, Bl.—Here and there in the tropical forests of Kamorta.

53. Elæocarpus (Monoceras) sp.—Nicobars (*teste* D.).

N. B. *Elaeo. paniculatus*, Wall., = *E. leucobotryus*, Miq. *Elaeo. obovatus*, G. Don. (1831) (Bth. Fl. Austr. I. 281, from Australia), has priority over *E. obovatus*, Arn. (in Act. Acat. Nat. Car. XVIII (1836), 323, from Ceylon), and the latter name has consequently to be changed into *E. Arnotti*.

LINEÆ.

54. Hugonia sp. ?—Nicobars (*teste* D.).

N. B. Dr. Hooker states in his Ind. Fl. I. 414 that there can be very little doubt but that *Roucheria* is *Sarcotheca* of Blume; but a reference to Miquel's Illustr. Arch. Ind. 69. t. 30 does not confirm his conclusion.

MALPIGHIACEÆ.

55. Hiptage Sumatrana, Miq.—Nankowry (Novara 177; Jelinek 158—*Kadoa*, inc.).

I believe not distinct from *H. Javanica*.

RUTACEÆ.

56. Evodia Roxburghiana, Bth.—Common in the tropical forests of Kamorta.

57. Acronychia Cyminosma, F. Muell.—Tropical forests of Kamorta.

58. Glycosmis arborea, Corr., var. β. insularis, Kurz in Trim. Journ. Bot. 1876, 38.—Common in the tropical and coral-reef-forests of Katchall and Kamorta; Kondil (g. c.) and Karnicobar (Novara 172).

59. Glycosmis trifoliata, Spreng., var. latifolia, Kurz in Trim. Journ. Bot. 1876, 37.—In the coral-reef-forests of Katchall.

60. Triphasia trifoliolata, DC.—In the beach-forests of Katchall, entering the coral-reef-forests.; Nankowry (Novara 173; Jelinek 111—*arei kene*, inc.); *kalatine*, inc. Katch.

61. Atalantia macrophylla, Kurz in Journ. As. Soc. Beng. 1875, 136.—Frequent in the beach-forests of all the islands; Nankowry (Novara 144 and 174; Jelinek 136—*karotje*, inc.).

62. Paramignya citrifolia, Hf.—Kondil (g. c.)

63. Citrus Hystrix, DC.—Rather frequent around the huts on the beaches of Katchall.

64. Citrus nobilis, Lour., var. β. Limonellus, Kurz in Journ. As. Soc. Beng. 1875, 137.—Frequent and like wild in the beach-forests of Kamorta, Katchall, and other islands; entering the coral-reef-forests.

65. Citrus decumana, L.—Cultivated on Karnicobar and elsewhere.

N. B. Dr. Diedrichsen records *Feronia elephantum*, Corr., as growing frequently on the Nicobars, but this seems to be an error.

OCHNACEÆ.

66. Ochna Andamanica, Kurz.—Frequent in the tropical forests of Kamorta; also Nankowry (Novara 170; Jelinek 125—*klang-hong*, inc.).

BURSERACEÆ.

67. Canarium sp.—Nicobars (*teste* D.)

MELIACEÆ.

68. Aglaia argentea, Bl.—Not unfrequent in the coral-reef-forests of the eastern coast of Katchall.

69. Aglaia Andamanica, Hiern.—Frequent in the coral-reef-forests of the eastern coast of Katchall.

70. Amoora ganggo (*Aglaia Ganggo*, Miq. in Ann. Mus. Lugd. Bat. IV. 47).—Not unfrequent in the coral-reef-forests of Katchall; also Great Nicobar (Novara 175; Jelinek 247—*kaheng*, inc.).

80. Carapa Moluccensis, Lamk.—Katchall (g. c.).

OLACINEÆ.

81. Ximenia Americana, Willd.—Karnicobar and Katchall (g. c.) (Novara 171).

82. Olax imbricata, Roxb., var. membranifolia, folia 5—6 poll. longa, 2½—3 poll. lata, ovata ad elliptico-ovata, brevissime et obtusiuscule acuminata v. apiculata, succulento-membranacea, in sicco tenuiter membranacea, viridissima, laxe reticulata; cætera ut in specie.—Rather rare in the coral-reef-forests of the eastern coast of Katchall.

83. Anacolosa puberula, Kurz.—Common in the tropical forests of Kamorta and Katchall.

84. Apodytes Andamanica, Kurz.—Frequent in the tropical and coral-reef-forests of Kamorta and Katchall; also Great Nicobar (Novara 123; Jelinek 277).

85. Cansjera Rheedii, Gmel.—Kondil (g. c.).

86. Champereya gnetocarpa, Kurz in Trim. Journ. Bot. 1875, 325.—Dispersed in the tropical forests of Kamorta; also Karnicobar (Novara 184; Jelinek 85—*tongé*, inc.).

CELASTRINEÆ.

87. Evonymus Javanicus, Bl.—In the tropical forests of Katchall;

Kondil (g. c.); Great Nicobar (Novara 188; Jelinek 245—*konlolâhame*, inc.).

88. Salacia platyphylla, Kurz in Journ. As. Soc. Beng. 1875, 203.—In the tropical forests of the eastern coast of Katchall; also Nankowry (Novara 187 and 188; Jelinek 169—*tanglaschi*, inc.) and Great Nicobar (Novara 186; Jelinek 258—*tenfala*, inc.).

Very near to *S. macrophylla*, Bl. The specimens brought home by the Novara have all one-seeded berries, and thus the one I described appears only exceptionally 2-seeded.

89. Hippocratea Nicobarica, Kurz in Journ. As. Soc. Beng. 1875, 203.—In the tropical forests of the eastern coast of Katchall.

RHAMNEÆ.

90. Zizyphus subquinquenervia, Miq.—Common in the tropical forests of Kamorta and Katchall.

91. Colubrina Asiatica, Brongn.—Frequent in the beach-forests of Kamorta and Katchall; also Karnicobar (g. c.); *putjang*, inc. Katch.

92. Gouania sp.—Nicobars (*teste* D.).

AMPELIDEÆ.

93. Vitis lanceolaria, Roxb.—Common in the tropical and coral-reef-forests of Kamorta and Katchall.

94. Vitis pedata, Vhl.—Common in the tropical-forests of Kamorta; also Nankowry (Novara 189; Jelinek, 146—*kaje*, inc.).

95. Vitis trifolia, L. (the glabrous variety).—Not unfrequent in the coral-reef-forests of Katchall.

96. Vitis Linnæi, Kurz in Journ. As. Soc. Beng. 1875, 176 (the variety called *V. riparia*, Wall.).—Karnicobar (g. c.).

97. Vitis repens, WA.—Frequent in the tropical forests of Kamorta.

98. Pterisanthes sp.—Nicobars (*teste* D.).

99. Leea grandifolia, Kurz in Trim. Journ. Bot. 1875, 325.—Very common in the beach-forests of the western coast of Katchall, entering also some of the coral-reef-forests; also Trice and Track (Novara 190; Jelinek 186—*hanod*, inc.).

100. Leea sambucina, L.—Frequent in the beach, coral-reef-, and tropical forests of Kamorta and Katchall; also Nankowry (Novara 76; Jelinek 171); *taku*, inc. Katch.

101. Leea aculeata, Bl.—Katchall (g. c.).

SAPINDACEÆ.

102. Cardiospermum Halicacabum, L.—Frequent in the beach-forests of Kamorta, Nankowry, and Katchall, especially around huts.

103. Allophylus Cobbe, Bl., not of Hiern (*A. littoralis*, Bl.; Kurz Journ. As. Soc. Beng. 1875. 185).—Common in the beach-forests of Kamorta and Katchall; also Trice and Track (g. c.); Great Nicobar (Novara 180; Jelinek 265—*nongamuje*, inc.).

104. Cupania Jackiana, Hiern.—Rather rare in the coral-reef-forests of the eastern coast of Katchall; also Karnicobar (Jack).

105. Cupania adenophylla, Planch.—Nankowry (Novara 187; Jelinek 129—*muju*, inc.).

106. Erioglossum rubiginosum, Brand. For. Fl. 108 (*E. edule*, Bl.).—Common in the tropical forests of Kamorta and Katchall; also Nankowry (Novara 179; Jelinek 153—*petal*,* inc.); *ahaya*, inc. Katch.

107. Sapindus Danura, Voigt.—Kondil (g. c.).

108. Sapindus montanus, Bl.—Frequent in the tropical forests of Kamorta, entering the beach-forests; also Nankowry (Novara 182; Jelinek 141—*nuje*, inc.).

109. Pometia tomentosa, Bth. and Hf.—Only one young tree met with in the coral-reef-forests of the eastern coast of Katchall, but very likely more frequent in the tropical forests of that island.

N. B. *Dodonaea? Lamponga*, Miq. Suppl. Fl. Sumatr. 511, = *Pteleocarpa Malaccensis*, Oliv.

ANACARDIACEÆ.

110. Rhus sp.—Nicobars (*teste* D.).

111. Mangifera sp.—Wild in the coral-reef-forests of Katchall, but I have seen only saplings.

112. Buchanania platyneura, nov. sp.

Arbor 40—60-pedalis, glabra, gemmis fulvo-v. ochraceo-sericeis; folia crasse coriacea, lanceolata, in petiolum latum crassum 2—6 lin. longum attenuata et basi sæpius subinequalia, obtuse acuminata, vulgo 4—6 (immo 11) poll. longa, integra, utrinque lucidula, glaberrima, costâ latâ planâ parum prominulâ venisque tenuibus utrâque paginâ prominulis percursa; flores parvi, albi, pedicellis gracilibus fugaciter pilosulis vix lin. longis suffulti, cymulosi et in paniculas numerosas glabras foliis vix longiores terminales dispositi; sepala ovalia, obtusa, circ. $\frac{1}{3}$ lin. longa, glabra; drupæ oblique ovoideæ, pisi majoris magnitudine, obtusæ, atropurpureæ, glabræ; putamen globosum, durissimum, læve.—*B. splendenti*, Miq., et *B. lucidæ*, Bl., affinis.—Frequent in the tropical forests of Kamorta.

113. Odina Wodier, Roxb.—Frequent in the beach-forests of Ka-

* "*Petal*" occurs as a name for several different plants in Jelinek's journal; I fear it is meant for '*bétúl*' ('just so', 'right so'), a very usual reply of a Malay to a question regarding the pronunciation of a word.

morta and Katchall; on the first-named island here and there also on the hills along the outskirts of the tropical forests. *Gantéál*, inc. Katch.

114. SEMECARPUS HETEROPHYLLUS, Bl.—Frequent in the beach-forests of Katchall, entering the coral-reef-forests; also Karnicobar (Novara 210; Jelinek 30—*pep* or *boab*, inc.)

Var. *β*. PUBESCENS, paniculæ magis fulvo-tomentosæ, folia subtus puberula, reticulatione densiore.—Great Nicobar (Novara 209; Jelinek 251).

N. B. I have not seen authentic specimens of Blume's species, but the Nicobar (and Andaman) plant agrees with Sumatran specimens thus named by Miquel. The leaves vary much in size, and in saplings they are up to 2½ ft. long and of proportionally thinner texture and looser net-venation. The pubescent form, collected by Jelinek, stands in the same relation to the original form as my *S. albescens* to the glabrous form which I incorrectly named *S. heterophyllus* in my Pegu Report. This tendency to become pubescent is peculiar to a great number of tropical trees, and is not attributable, as some may suggest, to a drier or sunny station, but seems to be rather idiosyncracy. For we often find the two states growing side by side in the densest shade of the tropical forests. This is the case, for example, with *Micromelum pubescens,* while the perfectly glabrous and the almost villous-pubescent form (which I formerly distinguished as *V. pubescens*) of *Vanqueria spinosa* grow similarly associated in the dry hot forests of Prome. Other examples of the same phenomenon are afforded by *Garuga pinnata* and *G. mollis*, *Chickrassia tabularis* and *Ch. velutina*, *Schrebera Swietenia* and *Sch. pubescens*, *Holarrhena Codaga* and *H. antidysenterica*, *Trewia nudiflora* and the glabrous form, *Berrya Amonilla* and *B. mollis*, *Grewia lævigata* and its pubescent form, *Walsura trijuga* and *W. pubescens*, *Amoora Rohituka* and *A. Aphanomyxis*, *Terminalia catappa* and its pubescent form, and numerous others. In two only of these, viz., in *Berrya* and *Micromelum,* have I observed real intermediate and therefore connecting states. In most of these cases not only are the vegetative parts affected but the calyx and the corolla also.

CONNARACEÆ.

115. ROUREA FLORIBUNDA, Miq.—In the tropical forests of Katchall; also Nankowry (Novara 211; Jelinek 140—*majing*, inc.) A tree 3—4 feet in girth.

115-6. ROUREA WALLICHIANA, Planch.? (*Connarus mimosoides*, Vhl. Symb. III. 87).—Nicobars (*teste* Vahl.)

116. CONNARUS MAINGAYI, Hf.—Great Nicobar (Novara 237; Jelinek 260—*el*, inc.).

LEGUMINOSÆ.

117. Crotalaria calycina, Schrank.—Kamorta, rare along a rivulet in the grass-heaths.

118. Crotalaria sericea, Retz.—Kamorta, rare along a rivulet in the grass-heaths east of Enaca.

119. Smithia sensitiva, Ait.—Kamorta, locally common along rivulets in the grass-heaths.

120. Desmodium umbellatum, DC.—Common in the beach-forests all along the coast of all the islands; Nankowry (Novara 231; Jelinek 80—*kenjap*).

121. Desmodium (Dicerma) sp.—Nicobars (*teste* D.)

122. Desmodium recurvatum, Grah.—Kondil (g. c.).

123. Desmodium Gangeticum, DC.—Nicobars, no precise locality given (Novara 233; Jelinek.).

124. Desmodium polycarpum, DC.—Not unfrequent in the shrubberies along the margins of the tropical forests of Kamorta; Great Nicobar (Novara 234; Jelinek 234—*ptealam*, inc.).

125. Desmodium heterophyllum, DC.—Not unfrequent in the grass-heaths and also amongst shrubbery of the beach-forests of Kamorta.

126. Pycnospora nervosa, WA.—Rather frequent in the grass-heaths of Kamorta.

127. Uraria picta, Desv.—Here and there in the grass-heaths of Kamorta.

128. Uraria lagopodioides, DC.—Frequent in the grass-heaths of Kamorta.

129. Alysicarpus sp.—Nicobars (*teste* D.).

N. B. *Pisum sativum*, L., var. *arvense* is cultivated by the convicts on Kamorta, but succeeds very badly. Along with it come up (in a similar starved condition) *Vicia sativa*, L. and *Lathyrus Aphaca*, L., which have no doubt been introduced from Bengal.

130. Abrus precatorius, L.—Karnicobar (Novara 226; Jelinek —*tanjam*, inc.); Nankowry (Novara 226; Jelinek 110—*kaipi*, inc.).

131. Clitorea ternatea, L.—Nicobars (*teste* D.).

132. Erythrina Indica, L.—Not unfrequent in the beach-forests of Kamorta and the eastern coast of Katchall; also Karnicobar (Jelinek —*bamillo*, inc.).

133. Mucuna gigantea, DC.—Nankowry (Novara 235 and 236; Jelinek 166 and 155—*ipuë*).

134. Canavalia virosa, WA.—Not unfrequent amongst shrubbery along the outskirts of the tropical forests and in the beach-forests of Kamorta and Katchall; Nankowry (Novara 230; Jelinek 142—*komipuë*); *banyu*, inc. Katch.

N. B. Some species of *Phaseolus* and also *Dolichos Lablab*, L., are cultivated by the convicts on Kamorta, but do badly.

135. Vigna lutea, A. Gray.—Common along the sand-beaches and in the beach-forests along the coast of all the islands (Novara 229 ; Jelinek 103) *deimo-opo*, inc. Katch.

*136. Cajanus Indicus, L.—Nicobars, cultivated (*teste* D.).

137. Flemingia strobilifera, Ait.—Along the outskirts and in open bushy parts of the tropical forests of Kamorta, frequent ; Nankowry (Novara 232 ; Jelinek—32—*karan kofot*, inc.).

138. Dalbergia sp.—Nicobars (*teste* D.).

139. Derris uliginosa, Bth.—Frequent in the beach-forests and in the drier parts of the mangrove-swamps of all the islands ; Great Nicobar (Novara 238 ; Jelinek 248—*jlonja*, inc.).

140. Derris scandens, Bth.—Kamorta, not unfrequent along the coast, especially in the beach-forests and around mangrove-swamps.

141. Derris thyrsiflora, Bth. (*D. polythyrsa*, Miq. Suppl. Fl. Sumatr. 297).—Common in the tropical forests of Kamorta.

142. Pongamia mitis (*Robinia mitis*, L. ; *P. glabra*, Vt.).—Common in the beach-forests of all the islands ; (Novara 181).

143. Sophora tomentosa, L.—Rather frequent in the beach-forests of Kamorta and Katchall ; Karnicobar (Novara 239 ; Jelinek 56—*ature*, inc.).

144. Peltophorum ferrugineum, Vog.—Here and there in the beach-forests and coral-reef-forests of Kamorta ; Nankowry (Novara 240 ; Jelinek 134—*klarenje*, inc.).

N. B. *Cæsalpinia dasyrhachis*, Miq. Suppl. Fl. Sum. 292, is a new species of *Peltophorum*.

145. Cæsalpinia nuga, Ait.—Frequent in shrubbery of the beach-forests and around mangrove-swamps, entering also the tropical forests of Kamorta and Katchall.

146. Cæsalpinia Bonduc, L.—Not unfrequent amongst shrubbery of the beach-forests of Kamorta and Katchall.

*147. Cæsalpinia pulcherrima, Sw.—Nankowry, at the village of Malacca.

148. Cassia occidentalis, L.—A weed in the beach-forests around the huts of Kamorta.

149. Bauhinia ferruginea, Wall.—Great Nicobar (Novara 241 ; Jelinek 222—*nonong toak*, inc.).

150. Afzelia bijuga, A. Gray.—Frequent in the beach-forests of Kamorta and Katchall.

*151. Tamarindus Indica, L.—Nicobars (*teste* D.).

152. Cynometra bijuga, Spanogh.—Not unfrequent in the beach- and coral-reef-forests of Kamorta and Katchall.

153. Cynometra ramiflora, L.—Nicobars (Novara 145), probably only cultivated.

154. Entada scandens, Bth. (the typical form with retuse leaflets). Frequent in the forests, especially the beach-forests, of Kamorta; Nankowry (Novara 228; Jelinek—*otoaka*, inc.).

155. Adenanthera pavonina, L.—Great Nicobar (Novara 227; Jelinek 278).

N. B. *Mimosa* and *Acacia* are given as Nicobarese plants in Diedrichsen's list.

156. Albizzia stipulata, Boiv.—Common in the tropical forests of Kamorta.

157. Albizzia littoralis, T. et B.—Nankowry (Novara 243; Jelinek 134); Great Nicober (Novara 244; Jelinek 239—*unjiha*, inc.).

158. Albizzia bubalina (*Pithecolobium bubalinum*, Bth.; *Pitheco. oppositum*, Miq. Suppl. Fl. Sum. 283).—Not unfrequent in the tropical forests of Kamorta; Nankowry (Novara 242; Jelinek 133—*kawas*, inc.).

N. B. *Pithecolobium confertum*, Bth., = *Albizzia splendens*, Miq. Suppl. Fl. Sum. 280. Bentham is correct in his identification of *Pithec. acutangulum*, Miq., with *P. angulatum*, Bth. *Mastersia cleistocarpa*, Bak. in Hf. Ind. Fl. II. 195, = *M. Assamica*, Bth. in Linn. Trans. xxv. 300, t. 34.

159. Albizzia clypearia (*Pithecolobium clypearia*, Bth.).—Only once met with in the coral-reef-forests of the eastern coast of Katchall.

160. Albizzia fasciculata (*Pithecolobium fasciculatum*, Bth.), the form called *Pithec. macrophyllum*, T. et B.—Here and there in the tropical forests of Kamorta.

N. B. I follow v. Mueller and Scheffer in throwing together *Albizzia* and *Pithecolobium*, the differences pointed out by Bentham appearing to me not to be of generic value.

ROSACEÆ.

161. Parastemon urophyllus, DC., var.? β. macrocarpa, folia latiora et rigidiora; drupæ pollicem longæ, pulcherrime roseæ.—A beautiful tree 30 to 40 feet in height, with a dense round crown, not unfrequent in the tropical forests of Kamorta.

162. Rubus Moluccanus, L.—Not unfrequent in the shrubberies along the outskirts of the tropical forests (and often entering them) of Kamorta; Nankowry (Novara 225; Jelinek 170—*klintuum*, inc.).

N. B. The rose is cultivated at the penal station of Kamorta and thrives beautifully.

RHIZOPHORACEÆ.

163. Rhizophora mucronata, Lamk.—Common in the mangrove-swamps of all the islands. (Novara 215).

164. Ceriops Candolleana, Arn.—Karnicobar.

165. Bruguiera gymnorhiza, Lam.—Common along the coast of all islands in the mangrove-forests where these come in contact with fresh-water; Karnicobar (Novara 216; Jelinek—*tafáta* or *lintji*, inc.).

166. Carallia integerrima, DC.—Rare in the tropical forests of Kamorta.

COMBRETACEÆ.

167. Terminalia catappa, L.—Common in the beach-forests all along the coasts of the islands; *gumlan*, inc. Katch.

168. Terminalia sp. nov.—Frequent in the tropical forests of Kamorta.—One of the highest trees, much resembling the preceding in habit, but the leaves are much narrower and more cuneate and altogether of a different appearance. Fruits and flowers unknown.

169. Terminalia citrina, Roxb., var. Malayana, petioles longer and slender, leaves more acuminate, drupes little more than half the size.—Nankowry (Novara 75; Jelinek 132—*ohang*, inc.).

170. Lumnitzera littorea, Voigt.—A single tree found along one of the rivulets on the grass-heaths west of Enaca, Kamorta. It is a beach-forest-tree, the occurrence of which on polycistina-clay is abnormal.

171. Lumnitzera racemosa, Willd.—Great Nicobar (g. c.).

172. Combretum squamosum, Roxb.—Not unfrequent in the tropical forests of Katchall.

173. Combretum extensum, Roxb.—Karnicobar (g. c.).

174. Gyrocarpus Jacquini, Roxb.—Coast-forests of the Nicobars.

MYRTACEÆ.

*175. Psidium guyava L.—In the beach-forests, around the huts of the natives, like wild on Kamorta and Katchall.

176. Rhodamnia trinervia, Bl., var. concolor (*R. concolor*, Miq.). Common in the tropical forests of Kamorta.

177. Eugenia Javanica, Lamk.—Frequent in the beach-forests, and generally in the jungles bordering the sea, of Katchall; Pooloo Milu (Novara 223; Jelinek 206—*ipo*, inc.).

178. Eugenia occlusa (*Syzygium occlusum*, Miq.).—A lofty tree common in the coral-reef- and tropical forests of Katchall.

179. Eugenia claviflora, Roxb.—A tree (40 + 10 + 3 — 4) rather scarce in the tropical forests of Kamorta, but a shrubby variety of it is common on the grass-heaths of Kamorta; Great Nicobar (Novara 224; Jelinek 261—*antanyschumna*, inc.).

180. Eugenia (Acmena ?) sp., in leaf only.—Frequent in the tropical forests of Kamorta.

181. Barringtonia racemosa, DC.—Frequent in the tropical and coral-reef-forests of Kamorta and Katchall; Karnicobar (Novara 220; Jelinek 64—*pisseon*, inc.); Great Nicobar (Novara 231; Jelinek 220—*sura*, inc.).

182. Barringtonia Asiatica, Kurz in Pegu Rep. A. 65 (*B. speciosa*, L. f., non Forst.)—Common in the beach-forests all along the coasts of the islands; Karnicobar (Novara, Jelinek—*kenjao* or *hoa*, inc.); *howa*, inc. Katch.

MELASTOMACEÆ.

183. Osbeckia sp.—Nicobars (*teste* D.)

184. Melastoma Malabathricum, L. and a small procumbent form of it not higher than ½—1 foot.—Common as shrubbery along the outskirts of the tropical forests and on the grass-heaths of Kamorta, the procumbent form restricted to the latter.

185. Melastoma polyanthum, Bl., var. ?—Nicobars (Novara 217; Jelinek).

186. Otanthera Nicobarensis, T. et B. in Naturk. Tydschr. Ned. Ind. XXIV. 333.—Tropical forests of Katchall; Great Nicobar (Novara 219; Jelinek 172).

187. Dissochæta, sp.—Nicobars (*teste* D.).

188. Pternandra cœrulescens, Jack.—Rare in the tropical forests of Kamorta.

189. Memecylon subtrinervium, Miq. Suppl. Fl. Sumatr. 322.

Var. grandifolia, folia 8—10 poll. longa, magis coriacea et nitidiora, nervis minus distinctis; petioli crassiores; pedicelli solitarii v. bini, 2—3 lin. longi, subgraciles, pedunculum 1—2 lin. longum articulatum supra foliorum cicatrices erumpentem terminantes; baccæ submaturæ obovoideo-oblongæ, c. 7—8 lin. longæ, læves, glabræ, calycis limbo speciei coronatæ.—Rare in the tropical forests of Kamorta. A small tree, which I identify with Miquel's *M. subtrinervium*, on the supposition that the berries in Miquel's plant would, when full grown, reach a similar size. As a species it is a very distinct one, being one of the few that have the berry not globular.

N. B. *Memecylon pauciflorum*, Wall. Cat. 4114 (Triana in Trans. Linn. Soc. XXVIII. 159), = *Canthium glomerulatum*, Miq.

ONAGRARIEÆ.

190. Jussiæa villosa, Lamk.—Locally frequent along marshy rivulets on the grass-heaths of Kamorta.

SAMYDACEÆ.

191. Casearia glabrata, Bl., var. leaves larger and broader at the base, which is more rounded or almost cordate on the one side, in this respect more resembling those of *C. angustata*, T. et B., which may turn out to be only a form of it. Capsules fleshy, elliptical, nearly an inch long, smooth and glabrous. A tree (30 — 50 feet + 15 — 20 + 3 — 4) rare in the tropical forests of Kamorta.

PASSIFLORACEÆ.

192. Modecca cordifolia, Bl.—Great Nicobar (Novara 155; Jelinek 229—*unaha*, inc.). To this should be referred *M. heterophylla* of my Andam. Rep. App. A. 39 (not of Blume).

193. Modecca Nicobarica, Kurz in Trim. Journ. Bot. 1875, 326. Frequent in the beach-forests of Katchall; Nankowry (Novara 156; Jelinek 148—*tenjam*, inc.).

*194. Carica papaya, L.—Cultivated and occasionally like wild in the beach-forests of Kamorta and Katchall. (Novara 157; Jelinek); *lapú*, inc. Katch.

CUCURBITACEÆ.

195. Gymnopetalum heterophyllum, Kurz in Trim. Journ. Bot. 1875, 326.—Not unfrequent in the tropical forests and locally in recently cultivated parts of the grass-heaths of Kamorta.

N. B. The difference between *Trichosanthes* and *Gymnopetalum* is very slight indeed. The corolla in *Trich. integrifolia (Cucumis integrifolia*, Roxb.) is as often entire as it is irregularly and more or less deeply cut; the colour of the corolla thus alone remains as a distinguishing mark between the two genera!

196. Lagenaria vulgaris, Savi, var. ?—Wild or like wild along the beach-forests of Katchall. The petioles and leaves are covered with bristles arising from calcareous incrassate tubercles; the fruits are of the shape and size of large billiard-balls.

197. Luffa cylindrica, Roem.—Along the outskirts of the tropical forests of Kamorta.

*198. Benincasa cerifera, Savi.—Cultivated and as wild in the neglected "gardens" on the grass-heaths of Kamorta.

*199. Cucumis melo, L., var. utilissima, Naud.—Kamorta, as wild in neglected "gardens" on the grass-heaths.

N. B. Besides these *Momordica* and *Citrullus* were observed as cultivated plants.

UMBELLIFERÆ.

200. Hydrocotyle sp.—Nicobars, (*teste* D.).

ARALIACEÆ.

201. Heptapleurum ellipticum, Seem.—Not an unfrequent climber in the tropical forests of Kamorta and Katchall; Great Nicobar (Novara 170; Jelinek 263—*kenankun*, inc.).

202. Arthrophyllum Blumeanum, Zoll. and Mor.—A palm-like tree up to 30 feet high and higher, frequent in the tropical forests of Kamorta.

CORNACEÆ.

203. Alangium Sundanum, Miq.—A large climber of the coral-reef-forests of Katchall, more frequent in the tropical forests.

CAPRIFOLIACEÆ.

204. Scyphiphora hydrophyllacea, Gærtn.—Rare in the mangrove-swamps of Kamorta.

N. B. This genus is generally ascribed to *Rubiaceæ*, but the structure of the ovary and the position of the ovules are tell-tale marks of its caprifoliaceous descent.

RUBIACEÆ.

205. Psychotria Nicobarica, Kurz in Trim. Journ. Bot. 1875, 328.—Frequent in the coral-reef-forests of the eastern coast of Katchall.

206. Psychotria tylophora, Kurz, l. c.—Not unfrequent in the tropical and coral-reef-forests of Katchall.

207. Psychotria Andamanica, Kurz, l. c.—Rather frequent in the coral-reef- and tropical forests of Katchall and Kamorta.

208. Psychotria connata, Wall.—Karnicobar (g. c.).

209. Amaracarpus pubescens, Bl.—Frequent in the tropical forests of Ho-Ho or Ulala Bay, on plutonic rocks.

N. B. Diedrichsen gives *Serissa* as a Nicobarese plant.

210. Ixora Pavetta, Roxb.—Not unfrequent in the beach- and coral-reef-forests of Katchall.

211. Ixora weberæfolia (*Pavetta weberæfolia*, Wall. Cat. 6182; Don. Gen. System III. 575).—Frequent in the tropical and coral-reef-forests of Katchall and Kamorta; Great Nicobar (Novara 92; Jelinek 264—*henjuan*, inc.); Karnicobar (Novara 93; Jelinek 55—*Joöjonkuo*, inc.).—Resembles *Webera Asiatica*, Bedd., to such a degree that it is frequently mistaken for it. My *Stylocoryne Webera* in And. Rep. also belongs here.

212. IXORA CUNEIFOLIA, Roxb., var. MACROCARPA, berries the size of a large pea.—Pulu Milu (Novara 91; Jelinek 203—*hiloga*, inc.).

213. IXORA KURZIANA, T. et B. in Natuurk. Tydsch. v. Ned. Ind. XXVII. 100 (sub *Pavetta*).—Rare in the tropical, more frequent in the coral-reef-forests of Katchall.

214. IXORA BARBATA, Roxb.—Great Nicobar (g. c.).

215. IXORA MACROSIPHON, Kurz in Trim. Journ. Bot. 1875, 327.—Great Nicobar (Novara 89; Jelinek 254—*hilogo*, inc.).

216. IXORA BRUNNESCENS, Kurz in Journ. As. Soc. Beng. 1872, 317.—Frequent in the coral-reef-forests of Katchall; Karnicobar (Novara 87 and 88; Jelinek—*lunge*, inc.).

217. IXORA VILLOSA, Roxb.—Kondil (g. c.)

218. LASIANTHUS LÆVICAULIS, Kurz in Trim. Journ. Bot. 1875, 327.—Rather frequent in the tropical forests of Kamorta.

219. GYNOCHTODES MACROPHYLLA, Kurz in Journ. As. Soc. Beng. 1872, 314 and Trim. Journ. Bot. 1875, 326.—In the beach-forests of Katchall; Nankowry, near Malacca.

220. GUETTARDA SPECIOSA, L.—Common in the beach-forests of all the islands; Trice and Track (Novara 97; Jelinek 185—*towalé*, inc.).

221. POLYPHRAGMON FLAVESCENS (*Helospora flavescens*, Jack).—Not unfrequent in the tropical forests of Kamorta, where it grows to be a tree up to 30 feet high, but very frequent on the grass-heaths of the same island, where it is reduced to a mere shrub; Karnicobar (Novara 99 and 100; Jelinek—*kointuel*, inc.).

N. B. What authors (except Miquel) take to be cells are in reality the ovules, which are attached usually in two rows to the inner angles of the 4—7 cells of which the ovary consists. The seeds have a crustaceous testa. The berries of the Nicobar tree are larger and usually 6-celled and may form a distinct species.

N. B. *Bobea hirsuta*, T. et B., = *Polyphragmon trichocaulon*, Miq.; *Greenia latifolia*, T. et B., = *Polyphr. Amboinicum*, Miq.

222. GARDENIA RESINIFERA, Korth. (the form called *G. glutinosa*, T. et B.). A tree (40—50 + 20 — 25 + 4 — 5) not unfrequent in the tropical forests of Kamorta.

223. GRIFFITHIA CURVATA, Kurz in Trim. Journ. Bot. 1875, 326.—Frequent in the tropical and the coral-reef-forests of Kamorta and Katchall.

224. WEBERA DENSIFLORA, Wall.—Frequent in the coral-reef-forests of Katchall.

224. HYPOBATHRUM RACEMOSUM (*Randia racemosa*, Roxb.; *Petunga Roxburghii*, DC.).—Not unfrequent in the coral-reef-forests of Katchall, especially near marshes; Great Nicobar (Novara 102; Jelinek 252—*pebel*, inc.).

225. MUSSÆNDA MACROPHYLLA, Wall.—Not unfrequent along the outskirts of the tropical forests of Kamorta; Nankowry (Novara 95; Jelinek 160).

226. MUSSÆNDA JELINEKII, nov. sp.

Fruticosa, subglabra; folia lineari-lanceolata ad elongato-obovato-lanceolata, basi cuneatâ acuminata et in petiolum longum v. longiusculum (½—2 pollicarem) attenuata, breviuscule acuminata, membranacea, 9—4 poll. longa, integra, glabra v. subtus pallidiora et sub lente minute pubera; flores parviusculi, aurantiaci, pedicellis 1—1½ lin. longis suffulti et in corymbum brachiatum glabrum foliis multo breviorem terminalem disgesti; calycis glabri tubus cylindraceo-oblongus, 1½ lin. longus, dentibus ⅓ lin. longis, omnibus lineari-subulatis v. uno alterove florum 1—2 tantum in laminam foliaceam albam longissime (c. 1. poll.) petiolatam excrescente; corollæ tubus 7—8 lin. longus, glaber, intus fauce villosus, lobi vix 2 lin. longi, oblongi, obtusiusculi, supra pulverulento-tomentelli.

Allied (possibly too closely?) to *M. longifolia.* The opposite leaves are alternately much smaller and shorter petioled. Great Nicobar (Novara 90; Jelinek 250—*tajhuge,* inc.).

227. ADENOSACME LONGIFOLIA, Wall.—Great Nicobar (Novara 222; Jelinek 224).

228. MORINDA CITRIFOLIA, L., var. BRACTEATA (*M. bracteata,* Roxb.).—Common in the beach-forests of Kamorta and Katchall, entering also the coral-reef-forests; Karnicobar (Novara 101; Jelinek 13—*huron,* inc.).

229. NAUCLEA EXCELSA, Bl.—A tree (60 + 20 — 30 + 4 — 5) frequent in the tropical forests of Kamorta.

230. UNCARIA PILOSA, Bth.—Frequent in the tropical forests of Kamorta.

231. OPHIORRHIZA MUNGOS, L.—Common in the beach- and coral-reef-forests of all the islands, especially frequent at the base of the catechu-palms; Pulu Milu (Novara 96; Jelinek 193—*kuju,* inc.).

232. HEDYOTIS RIGIDA, Miq.—Frequent in the tropical forests of Kamorta.

233. HEDYOTIS PARADOXA, nov. sp.

H. hispidæ, Retz., arcte affinis, attamen corolla duplo major, fauce pubescens; capsula globosa uti in speciebus *Oldenlandiæ,* calycis lobis brevibus coronata; caules hispiduli; folia supra glabra, subtus minute puberula. Great Nicobar (Novara. 94; Jelinek 225—*sanunkun,* inc.). (Common on the Andamans).

234. HEDYOTIS APPROXIMATA, WA., var. (*Spermacoce tubularis,* R. Br. in Wall. Cat.).—Pretty frequent on the grass-heaths of Kamorta, especially along rivulets.

235. HEDYOTIS COSTATA (*Spermacoce costata,* Roxb.; *H. coerulea,*

Korth., non WA.)—Not unfrequent in open spots and along the outskirts of the tropical forests of Kamorta.

N. B. *Hedyotis cœrulea,* WA. (non L., nec Korth.), has to be changed into *H. cyanantha.*

236. Hedyotis Wallichii (*H. galioides,* Wall. Cat. 866, non F. Muell.).

Herba annua, erecta, 1—2-pedalis, parce pilosa; stipulæ longe fimbriatæ, hispido-pilosæ; folia magis minusve ovato-lanceolata ad ovalia, basi acuta, petiolo 1—1½ lin. longo parce piloso suffulta, acuta v. acuminata, ½—1½ poll. longa, integra, membranacea, utrinque plus minusve pilis longis adspersa; flores minuti, pallide cœrulei, pedicellis capillaribus 3—4 lin. longis suffulti, cymas glabras dichotomas in paniculas axillares et terminales dispositas formantes; calyx glaber, vix semilineam longus, dentibus lanceolatis acutis; capsula hemisphærica, glabra, lineam fere in diametro, calycis dentibus brevibus coronata.

Common amongst grass in the grass-heaths, especially in those of the northern parts of Kamorta.

237. Hedyotis graminicola, Kurz in Trim. Journ. Bot. 1875, 326.—Common amongst grass in the grass-heaths of Kamorta.

238. Hedyotis racemosa, Lamk.—Great Nicobar (g. c.).

239. Hedyotis Andamanica, Kurz in Journ. As. Soc. Beng. 1872, 311.—Rather rare in somewhat open places in the tropical forests of Kamorta.

240. Knoxia corymbosa, Willd.—Trice and Track (g. c.).

COMPOSITÆ.

241. Vernonia cinerea, Less.—A weed in cultivated lands and around the huts of the natives in the beach-forests of Kamorta; Tillangchong (Novara 85; Jelinek 102).

242. Vernonia (Cyanopsis) sp.—Nicobars (*teste* D.).

243. Adenostemma viscosum, Forst.—One variety (var. *latifolia,* Don) frequent in the coral-reef- and tropical forests of Kamorta and Katchall; the other (var. *elatum,* Don), with succulent thick leaves, rather frequent in swampy rivulets of the grass-heaths of Kamorta.

244. Ageratum conyzoides, L.—A common weed around the huts of the natives and in the beach-forests of Kamorta and Katchall.

245. Blumea flava, DC.—Locally along rivulets of the grass-heaths of Kamorta.

246. Blumea lacera, DC.—Frequent in the beach-forests and around the penal settlement of Kamorta.

247. Blumea myriocephala, DC.—Here and there in shady ravines and in tropical forests of Kamorta; Trice and Track (g. c.); Great Nicobar (Novara 83: Jelinek 218—*kongé,* inc.).

248. Blumea riparia, DC.—Large scandent shrub, frequent in the tropical forests of Kamorta.

249. Blumea balsamifera, DC.—Springing up freely in cleared jungle-land and not unfrequent along the outskirts of the forests and amongst shrubbery of Kamorta.

250. Pluchea Indica, Less.—Frequent along the coast of Kamorta and Katchall; Trice and Track (g. c.).

251. Sphæranthus microcephalus, Willd.—Here and there on the grass-heaths of Kamorta, also springing up in cleared jungle-land.

252. Eclipta sp.—Nicobars (*teste* D.).

253. Synedrella nodiflora, Gærtn.—A weed near the convict-gardens of Kamorta and most probably introduced from the Andamans, where it has now become a common weed.

254. Wedelia scandens, C. B. Clarke.—Common in the tidal forests and the beach-forests of Kamorta and Katchall; Karnicobar (g. c.); Nankowry (Novara 84; Jelinek 112—*katei,* inc.); *kathai,* inc. Katch.

255. Spilanthes sp.—Nicobars (*teste* D.).

256. Bidens sp.—Nicobars (*teste* D.).

CAMPANULACEÆ.

257. Lobelia sp.—Nicobars (*teste* D.).

258. Scævola Kœnigii, Vhl.—Common in the beach-forests, but also on rocky (chiefly calcareous) ground near the sea along the coasts of all the islands; Karnicobar (Novara 36; Jelinek 58—*tuful,* inc.).

N. B. *Stylidium tenellum,* Kurz in Flora 1872, 304, non Sw., is a new species, which I now propose to call *St. roseum.*

MYRSINEÆ.

259. Mæsa ramentacea, Roxb.—Frequent in the tropical forests of Kamorta.

260. Embelia microcalyx, Kurz in Trim. Journ. Bot. 1875, 328. Frequent in the tropical forests of Kamorta.

Allied to *Emb. canescens,* Jack.

261. Myrsine capitellata, Wall. var.? (the form which goes under the name *M. avenis,* DC.).—Rare in the tropical forests of Kamorta. A small bushy tree about 30 feet high.

262. Ardisia littoralis, Andr. (*Climacandra obovata,* Miq.).—Common in the beach-forests of all the islands; Karnicobar (Novara 142; Jelinek 18—*mekron,* inc.).

263. Ægiceras corniculata, Blanco.—Nankowry (Novara 143; Jelinek 157—*kadoa,* inc.).

SAPOTACEÆ.

264. Sideroxylon attenuatum, DC.—Frequent in the tropical forests of Kamorta; Great Nicobar (g. c.); Karnicobar (Novara 146; Jelinek 11—*makelinioko*, inc.).

265. Sideroxylon grandifolium, Wall.—A lofty tree, rare in the tropical forests of Kamorta.

266. Mimusops Elengi, L.—A lofty tree, not unfrequent in the tropical forests of Katchall.

267. Mimusops littoralis, Kurz in Peg. Rep. 1875. E. 34. in erratis.

Arbor vasta, sempervirens, glabra; folia obovata ad obovato-oblonga, petiolo gracili $\frac{1}{2}$—1 poll. suffulta, basi acuta, $2\frac{1}{2}$—4 poll. longa, obtusa et vulgo retusa, coriacea, glabra, supra nitentia; flores parvi, pedicellis robustis subglabris $\frac{1}{2}$—$\frac{3}{4}$ (sub fructu usque ad $1\frac{1}{2}$) poll. longis suffulti, solitarii, axillares; calyx circ. 2 lin. longus, adpresse fulvo-puberulus et glabrescens, 6-lobus (an semper ?), lobis ovatis obtusiusculis; corollæ lobi sepalis triplo numerosiores: lobi exteriores 12, lineari-lanceolati; interiores 6, erecti, breviores et angustiores, basi attenuati et filamentorum basibus subadnati; stamina 12, glabra, cum squamis minutis totidem denticulatis alternantia; antheræ acuminatæ; ovarium fulvo-pubescens; baccæ depresso-globosæ et fere pomiformes, 1—$1\frac{1}{2}$ poll. circiter in diametro, læves, vulgo 5-v. 6-loculares et -spermæ; semina compresso-oblonga, semipollicem circiter longa, hilo conspicuo subbasali obliquo.

Frequent in the forests of the rocky coast of Katchall, especially along the northern and eastern sides.

The bullet-wood grows here as luxuriantly as on the Andamans, where at Ross-island itself seven trees, survivors of the former forests, are still standing.

EBENACEÆ.

268. Diospyros Kurzii, Hiern.—Rare in the coral-reef-forests of Katchall; said to occur also in the tropical forests of Kamorta; Nankowry (Novara 147; Jelinek 146).

269. Diospyros undulata, Wall.—Nankowry (Novara 149; Jelinek 126—*oka ohe*, inc.).

270. Maba Andamanica, (*Marcreightia Andamanica*, Kurz in And. Rep. 2nd ed. A. p. 42).

Frutex sempervirens, 3—5-pedalis, novellis ochraceo-hirsutis v. pubescentibus; folia elliptico- ad ovato-oblonga, petiolo brevissimo brunneo-tomentello suffulta, basi subcordata, abrupte acuminata v. apiculata, integra, 4—6 poll. longa, chartacea, supra glabra, subtus secus costam

nervosque adpresse fulvo-puberula, laxe reticulata; flores feminei tantum noti, 3-meri, axillares, sessiles, solitarii; calyx profunde 3-lobus, lobis acutis, parce pilosis; baccæ subsiccæ, elliptico-oblongæ v. oblongæ, plus quam pollice longæ, styloso-mucronatæ, læves, sæpius 3-spermæ; semina lineari-oblonga.—Tillangchong (Novara 148; Jelinek 105).

STYRACACEÆ.

271. Symplocos leiostachya, Kurz in Journ. As. Soc. Beng. 1873, 89 and in Trim. Journ. Bot. 1875, 329.—A lofty tree, common in the tropical forests of Kamorta, remaining low along the outskirts of the forests.

JASMINACEÆ.

272. Jasminum acuminatissimum, Bl.—Frequent in the tropical forests of Kamorta, and along their outskirts; Nankowry (Novara 103 and 104; Jelinek 121 and 162—*njod*, inc.).

273. Chionanthus Palembanicus, Miq. Suppl. Fl. Sum. 558.—Great Nicobar (Novara 73; Jelinek 255—*utenya*, inc.); Nankowry (Novara 74; Jelinek 125—*klanghong*, inc.).

N. B. Fruiting specimens from the Vienna Museum prove the species to be quite distinct from *Ch. ramiflorus*, Roxb., with which I identified the flowering specimens from the Andamans in my And. Rep. App. A. 42. The drupes are 1—1½ inches long, ovoid to oblong, slightly curved, the putamen smooth or, more usually, slightly and longitudinally furrowed. Neither do I believe that Roxburgh's Moluccan species is correctly identified with the Indian plant of the same name and with *Ch. macrophyllus* (*Linociera*—Wall.).

274. Chionanthus sp.? (leaves only). Not unfrequent in the coral-reef-forests of Katchall; (Novara 57; Jelinek).

APOCYNACEÆ.

275. Carissa diffusa, Roxb.—Karnicobar (g. c.).

276. Strychnos acuminata, Wall.—Nankowry (Novara 105; Jelinek 159—*schong*, inc.).

277. Fagraea racemosa, Jack.—Frequent in the tropical forests of Kamorta, but still more common as a small tree on the grass-heaths of the same island; Great Nicobar (Novara 106; Jelinek 241—*iloko*, inc.).

278. Gynopogon stellatum, Labill.—Nankowry, at Malacca.

279. Cerbera Odallum, Ham.—Not unfrequent in the beach-forests, and along the outskirts of the mangrove-swamps, of Kamorta and Katchall.

280. Ochrosia salubris, Miq.—Rather frequent in the beach-forests of Kamorta; Trice and Track (Novara 106/*a*; Jelinek 184—*bata*, inc.).

281. TABERNÆMONTANA CRISPA, Roxb., var. NICOBARICA (*T. Nicobarica*, Liebm. Ind. sem. Hort. Hanniensis et Linnæa XXVIII. 363), calycis lobis angustis subspathulatis tantum differt.—Common in the beach-forests of all the islands; Karnicobar (Kamphœvener; Novara 108 & 110; Jelinek 33 & 45—*togarata* or *takorota*, inc.); Trice and Track (Novara 109; Jelinek 182—*hlangnjei*, inc.); *galic naik*, inc. Katch.

282. AGANOSMA ACUMINATA, Don. (*A. euloba*, Miq.).—Karnicobar (g. c.).

283. ALSTONIA SPECTABILIS, R. Br.—Frequent in the coral-reef-forests of Katchall; (Jelinek—*tulano*, inc.).

284. ALSTONIA MACROPHYLLA, Roxb. and var. β. ACUMINATA (*A. acuminata*, Miq. Ann. Mus. Lugd. Bat. IV. 140), folia glaberrima, petiol breviores.—Both varieties with intermediate forms frequent in the tropical forests of Kamorta; Karnicobar (Novara 107; Jelinek 14).

285. PARSONSIA SPIRALIS, R. Br. (*Heligme Javanica*, Bl.).—Frequent in the tropical forests of Katchall; Karnicobar (Novara 111; Jelinek 82—*tehen*, inc.).

286. ANODENDRON PANICULATUM, DC.—Frequent in the beach and tropical forests of Kamorta.

N. B. This, as Mr. Homfray of Port Blair has pointed out to me, is the plant which furnishes the strong fibre used by the Andamanese for their bow-strings.

ASCLEPIADEÆ.

287. SARCOLOBUS GLOBOSUS, Wall.—Great Nicobar, in mangrove-swamps (Novara 112; Jelinek 249—*intijok*, inc.).

288. CYNOCTONUM WALLICHII, Dcne.—Kamorta, in shrubbery near the old cattlé-shed on the grass-heaths.

289. BIDARIA sp.? Fruiting specimens only.—Great Nicobar (Novara 114; Jelinek 232—*ekowische*, inc.).—Much resembles *B. tingens*, Dcne., but has the leaves much larger and the pods 6—8 in. long and narrowed into a stalk.

290. WATTAKAKA VIRIDIFLORA, Hassk.—Nicobars (*teste* D.).

291. DISCHIDIA NUMMULARIA, R. Br.—Rather frequent on trees, chiefly in the beach-forests, but also on the grass-heaths of Kamorta and Katchall.

292. DISCHIDIA BENGALENSIS, Coleb.—Common on trees, especially cocoa-nut trees, of the beach-forests of Kamorta and Katchall; (Novara 115; Jelinek).

293. HOYA HOOKERI, Wight.—Frequent on trees of the beach and tidal forests of Kamorta and Katchall; (Novara 113; Jelinek).

CONVOLVULACEÆ.

294. IPOMŒA VITIFOLIA, Sw.—Common in the tropical forests of Kamorta; Nankowry (Novara 127; Jelinek 163); Great Nicobar (Novara 128; Jelinek 230—*nakatal*, inc.).

295. IPOMŒA NICOBARICA, nov. sp.

Alte volubilis, perennis, glabra, ramulis subangulatis; folia e basi profunde sinuato-cordata lato-ovata, petiolo 1—3½ pollicari suffulta, obtusa et sæpius cum mucrone, integra, 1½—3 poll. lata et longa v. paullo longiora, membranacea, glabra, subtus pallidiora et obscurius venosa; flores majusculi, candidi, pedicellis strictis sursum subcrassioribus glabris suffulti et 2—3-ni, rarius solitarii, pedunculum brevissimum (vix 3—4 lin. longum) axillarem terminantes; calycis lobi 3½—4 lin. longi, lato-elliptici, obtusissimi, mucronati, scariosi, glabri, interiores latiores et obtusiores; corolla infundibuliformis, glabra, 1½ poll. longa, lobis lato-subcordatis mucronatis; capsulæ chartaceæ, depresso-globosæ, glabræ, pedicello elongato ¾—1-pollicari et parum incrassato suffultæ; semina subglobosa, 1½ lin. crassa, atra, lævia.—Ex affinitate *I. cymosæ.*

The leaves much resemble those of *I. obscura* or *I. denticulata*, but are much larger. Rather frequent in the more open parts of the tropical forests of Kamorta.

296. IPOMŒA SEPIARIA, Koen.—Karnicobar (Novara 133; Jelinek 26—*manyi*, inc.).—A form with narrower, almost sagittate and angular leaves.

297. IPOMŒA DENTICULATA, Choisy.—Common in the beach-forests and along the sandy shores of Kamorta and Katchall; Great Nicobar (g. c.).

298. IPOMŒA CAMPANULATA, L.—Not unfrequent amongst shrubbery in the beach-jungles of Kamorta; Pulu Milu (Novara 132; Jelinek 212—*minjab*, inc.).

299. IPOMŒA TURPETHUM, R. Br.—Not unfrequent in shrubbery of the beach-forests of Katchall; (Novara 129; Jelinek).

300. IPOMŒA PES-CAPRÆ, Sw.—Common along the beaches and in the beach-forests of all the islands; Karnicobar (Novara 131; Jelinek 37—*lanankap*, inc.).

301. IPOMŒA LINIFOLIA, Bl.—Frequent amongst grass, along rivulets, on the grass-heaths of Kamorta.

N. B. Dr. Diedrichsen enumerates also *Lepistemon*, *Calonyction*, and *Aniseia* in his list of Nicobarese plants.

302. EVOLVULUS LINIFOLIUS, L. (with white flowers).—Locally on the grass-heaths of Kamorta.

303. ERYCIBE PANICULATA, Roxb. var.—A large climber, frequent in the tropical forests of Kamorta; Karnicobar (g. c.).

BIGNONIACEÆ.

304. Radermachera Lobbii, Miq.—A large tree up to 80 feet high, common in the tropical forests of Kamorta.

305. Spathodea Rheedii, Wall.—Katchall (g. c.).

ACANTHACEÆ.

306. Thunbergia sp.—Nicobars (*teste* D.).

307. Acanthus ilicifolius, L.—Along tidal marshes, Kamorta.

308. Ebermayera lanceolata, Hassk.—Great Nicobar (g. c.).

309. Hemiagraphis glandulosa, T. And.—In open or cleared spots in the coral-reef-forests of Katchall; Karnicobar (Novara 139; Jelinek 31—*samtarod*, inc.).

310. Hygrophila salicifolia, NE.—Not unfrequent along rivulets in the grass-heaths of Kamorta.

311. Peristrophe acuminata, NE.—Here and there in the coral-reef-forests of Katchall; Great Nicobar (g. c.).

312. Dædalacanthus suffruticosus, T. And.—Karnicobar (g. c.).

313. Eranthemum succifolium, nov. sp.

Herba annua, succulenta, glabra, 1—2½-pedalis, caule viridi v. fuscescente (nunquam albo); folia lanceolata ad elliptico-lanceolata, basi acuta, petiolo usque pollicari crasso suffulta, obtuse v. acutiuscule acuminata, 4—8 poll. longa, succulento-coriacea, glaberrima, nitida, in sicco fuscescentia; flores speciosi, candidi, pedicellis 1—2 lin. longis puberulis suffulti, 2—3-ni v. raro per plures fasciculati et secundi, bracteis linearibus pedicellos æquantibus v. brevioribus sustenti et paniculam vulgo amplam rarius contractam brachiatam minute puberulam terminalem efformantes; calycis laciniæ subulatæ, 3 lin. longæ; corollæ tubus 1—1½ poll. longus, limbus subbilabiatus, lobi inferiores 3 lato-obovati subacuti, basi usque ad quartam partem longitudinis connati, lobi superiores 2 oblongi, acutiusculi, basi usque ad ⅓ partem connati; capsulæ clavatæ in partem sterilem fere semipollicarem attenuatæ, normaliter 4-spermæ; semina compressa, orbiculari-reniformia, glabra, rugosissima.—Ex affinitate *E. Blumei.*

Common in the beach-forests of Kamorta and Katchall; Great (Nicobar (g. c.); Karnicobar (Novara 141; Jelinek 78—*okpakue* inc.).

314. Eranthemum album, T. And. ?—Karnicobar and Katchall (g. c.).

315. Justicia vasculosa, Wall.—Katchall; Trice and Track, and Great Nicobar (g. c.).

316. Justicia Sumatrana (*Gendarussa ? Sumatrana*, Miq. Fl. Ind. Bat. II. 832.)—Frequent in the tropical forests (calcareous) of the eastern coast of Katchall. The corolla is uniformly white.

PEDALINEÆ.

*317. Sesamum Indicum, DC.—Nankowry, at Malacca; cultivated?

CYRTANDRACEÆ.

318. Epithema carnosum, DC. var.—On shady coral-rocks in the tropical forests of the eastern coast of Katchall, rare.

319. Cyrtandra sp.? (leaves only).—Katchall (g. c.).

N. B. *Cyrtandra acuminata*, Wall. in Trim. Journ. Bot. 1875, 329, requires comparison with *Cyrtandromœa decurrens*, Zoll. Syst. Verz. part 3. 58—a species unknown to me.

LENTIBULARIEÆ.

320. Utricularia diantha, Roem. and Schult.—In a rivulet on the grass-heaths east of Enaca, Kamorta.

SCROPHULARINEÆ.

321. Scoparia dulcis, L.—A common weed in the beach-forests and on cleared lands, around the huts of the natives, etc., in Kamorta and Katchall.

322. Torenia cordifolia, Roxb.—In shrubberies in cleared or open places, especially along road-sides, in the tropical forests near the penal settlement at Kamorta.

323. Bonnaya sp.—Nicobars (*teste* D.).

324. Limnophila hirsuta, Bth., var. scaberrima. Folia rugosa, supra tuberculis hyalino-albidis calcareis et setulis boragineo-scaberrima, subtus punctata et hirsuta.

Rather frequent along swampy rivulets on the grass-heaths of Kamorta.

325. Adenosma hirsutum (*Pterostigma hirsutum*, Bth.), var. bracteis longioribus.—Rare and but local on the grass-heaths of Kamorta.

326. Striga hirsuta, Bth. (with yellow flowers).—Rare and sporadic on the grass-heaths of Kamorta.

327. Centranthera hispida, R. Br.—Only one specimen met with on the grass-heaths of Kamorta.

VERBENACEÆ.

328. Vitex Negundo, L.—Rather frequent in the beach-forests of Kamorta and Katchall, also found occasionally on the grass-heaths of Kamorta; Pulu Milu (Novara 121; Jelinek—*hita*, inc.).

329. Stachytarpha Indica, Vhl.—Frequent in grass-land and shrubbery around the penal settlement on Kamorta.

330. Premna integrifolia, L.—Frequent in the beach-forests of Kamorta and Katchall; Karnicobar (g. c.); *tanyól*, inc. Katch.

N. B. *Sphænodesma eryciboides*, Kurz in Journ. As. Soc. Beng. 1871, 76, = *Symphorema grossa* (*Premna? grossa*, Wall. Cat. 1874; DC. Prodr. XI. 638). *Sphenodesma* and *Symphorema* are in my opinion not generically distinct.

331. Clerodendron inerme, L.—In the beach and tidal forests of Kamorta; Karnicobar (Novara 118; Jelinek 25—*manjudjon*, inc.).

332. Clerodendron paniculatum, L.—Nicobars (Novara 117; Jelinek).

333. Callicarpa longifolia, Lamk.—Common in the beach-jungles of all the islands; Karnicobar (Novara 119; Jelinek 51—*kimvidang*, inc.); Nankowry (Novara 120; Jelinek 117—*kalafat*, inc.).

334. Gmelina Asiatica, L.—Rather frequent near the old cattle-shed on the grass-heaths north of the penal settlement of Kamorta; probably only an intruder from the tropical forests, where it ought to be found.

BORAGINEÆ.

335. Ehretia sp.—Nicobars (*teste* D.).

336. Cordia subcordata, Lamk.—A large shrub along the sea-shore, especially along beaches, of the eastern coast of Kamorta; Nankowry, (Novara 122; Jelinek 122—*njod*, inc.).

337. Tourneefortia argentea, L.—Common in the beach-forests, especially along the sea-border itself, of Katchall; Trice and Track (g. c.); (Novara 124; Jelinek).

338. Tourneefortia glabra (*Tetrandra glabra*, Miq.).—Scandent, in patches of low jungle along one of the rivulets in the grass-heaths of Kamorta; Katchall (g. c.).

LABIATÆ.

339. Ocymum sanctum, L.—Frequent around the huts of the natives in the beach-forests of Kamorta and Katchall; Nankowry (Novara 116; Jelinek 110—*tschamenga*, inc.).

340. Dysophylla auricularia, Bth.—In a swampy rivulet on the grass-heaths west of Enaca, Kamorta.

*341. Hyptis suaveolens, Poir.—As wild around the huts of the natives at Malacca, Nankowry.

Diedrichsen mentions *Orthosiphon* also as a Nicobarese plant.

342. Leucas sp.—Nicobars (*teste* D.).

NYCTAGINEÆ.

343. Boerhaavia glutinosa, Vhl.—Nicobars (*teste* Vahl.).

AMARANTACEÆ.

344. Amarantus viridis, L.—Not unfrequent around the huts of the natives in the beach-forests of Katchall and Kamorta; *aygóbó*, inc. Katch.

345. Amarantus Gangeticus, L.—Around the huts of the natives in the beach-forests of Katchall.

346. Aerva lanata, Juss.—Frequent in the beach-forests of Katchall; *dyu-al*, inc. Katch.

347. Alternanthera sp.—Nicobars (*teste* D.).

348. Achyranthes aspera, L.—Nicobars (Novara 67; Jelinek).

349. Cyathula prostrata, Bl.—Great Nicobar (Novara 68; Jelinek 215—*teünji*, inc.).

350. Desmochaeta sp.—Nicobars (*teste* D.).

POLYGONEÆ.

351. Polygonum flaccidum, Roxb.—In a jungle-marsh in the coral-reef-forests behind Katjui, on the western coast of Katchall.

MONIMIACEÆ.

352. Kibara coriacea, Hf. & Th.—Great Nicobar (Novara 69; Jelinek 270).

LAURINEÆ.

353. Cinnamomum obtusifolium, N. E.—Not unfrequent in the tropical forests of Kamorta; Nankowry (Novara 71; Jelinek 144—*montam*, inc.).

354. Cryptocarya ferrea, Bl.—Rather rare in the tropical forests of Kamorta.

N. B. Diedrichsen gives *Polyadenia* also as Nicobarese.

355. Tetranthera laurifolia, Jacq.—Pulu Milu (Novara 70; Jelinek 210—*bogiak*, inc.); Great Nicobar (g. c.).

356. Tetranthera amara NE., var. γ. Andamanica (v. sp. propria?), folia multo majora et tenuiora; umbellæ numerosæ, pedunculis gracilibus usque ad 4 lin. longis suffultæ.—Karnicobar (Novara 72; Jelinek 35—*takawoka*, inc.).

357. Litsæa foliosa, NE.—Common in the tropical forests of Kamorta; Nankowry (Novara 76; Jelinek 137—*ulenja*, inc.).

358. Cassytha filiformis, L.—Common in the beach-forests of Kamorta and Katchall; Karnicobar (Novara 79; Jelinek 60—*kumbraga*, inc.).

359. Hernandia peltata, Meissn.—Common in the beach-forests of Kamorta and Katchall; Karnicobar (Novara 80; Jelinek 40—*minhud*).

LORANTHACEÆ.

360. Loranthus sp.—Nicobars (*teste* D.).

SANTALACEÆ.

361. Henslowia erythrocarpa, Kurz in Trim. Journ. Bot. 1875, 329.—Rare in the tropical forests of Kamorta.

ELÆAGNACEÆ.

362. Elæagnus arborea, Roxb.—In shrubbery along the tropical forests of Kamorta; Nankowry (Novara 81; Jelinek 164—*klumhang*, inc.).

THYMELÆACEÆ.

363. Gonystylus Miquelianus, T. et B.—Rare in the tropical forests of Kamorta.

ARISTOLOCHIACEÆ.

364. Bragantia tomentosa, R. Br.—Katchall and Trice and Track (g. c.); Great Nicobar (Novara 82; Jelinek 223—*taman*, inc.).

N. B. Diedrichsen mentions *Aristolochia* also.

MYRISTICACEÆ.

365. Myristica corticosa, Hf. and Th.—Not unfrequent in the tropical forests of Kamorta.

EUPHORBIACEÆ.

366. Actephila Javanica, Miq.—Katchall (g. c.).

367. Actephila puberula, Kurz in Journ. As. Soc. Beng. 1873, 236.—Common in the tropical and the coral-reef-forests of Katchall; Tillangchong (Novara 199 and 192; Jelinek 100).

368. Glochidion calocarpum, Kurz in Trim. Journ. Bot. 1875, 330.—Common in the beach and coral-reef-forests of Kamorta and Katchall; Karnicobar (Novara 204; Jelinek 50—*kinfidn*, inc.); Great Nicobar (g. c.).

369. Phyllanthus Niruri, L.—A weed around the huts of the natives in the beach-forests of Katchall.

370. Breynia oblongifolia, Muell. Arg. (var. foliis majoribus). A small tree in the coral-reef-forests of Katchall.

371. Breynia racemosa, Muell. Arg.—Not unfrequent in the beach- and coral-reef-forests of Katchall; Great Nicobar (Novara 196; Jelinek 228—*henonguiwe*, inc.).

372. Breynia rhamnoides, Muell. Arg.—Nankowry (Novara 205; Jelinek 161—*matmeijong*, inc.).

N. B. Diedrichsen enumerates *Cicca* in his list of Nicobarese genera.

373. Securinega obovata, Muell. Arg.—Not unfrequent in the beach and coral-reef-forests of Kamorta and Katchall, rarely entering the tropical forests; Karnicobar (Novara 193; Jelinek 43—*hengot*, inc.).

374. Antidesma Menasu, Muell. Arg.—Karnicobar (Novara 66; Jelinek 54—*senepkomó*, inc.).

375. Antidesma puncticulatum, Miq.—Not unfrequent in the tropical forests of Kamorta.

376. Antidesma persimilis, Kurz in Trim. Journ. Bot. 1875, 330.—Not unfrequent in the tropical forests of Kamorta.

377. Antidesma Ghæsembilla, Gærtn.—Common on the grass-heaths of Kamorta.

378. Aporosa glabrifolia, Kurz in Trim. Journ. Bot. 1875, 330. Common on the grass-heaths of Kamorta.

379. Aporosa microstachya, Muell. Arg.—Rather frequent in the tropical forests of Kamorta; Great Nicobar (Novara 212; Jelinek 262—*lamacha*, inc.).

380. Baccaurea Javanica, Muell. Arg. (*B. acuminata*, Muell. Arg.).—A tree 60 feet high by 8—10 feet in girth, on Nankowry (Novara 213; Jelinek 167—*lanob*, inc.).

N. B. *Adenocrepis Javanica*, Bl., and *Microsepala acuminata*, Miq., are in my opinion the same plant, but Miquel named some specimens from the Lampongs (Herb. Bog. No. 4531) also by the latter name. These differ greatly by the very short racemes and by the leaves drying yellow like those of a *Symplocos*.

381. Cyclostemon leiocarpum, Kurz in Trim. Journ. Bot. 1875, 330.—Here and there in the tropical forests of Kamorta.

382. Briedelia glauca, Bl.—Not unfrequent in the beach-forests of Kamorta and Katchall; (Novara 195, Jelinek).

383. Briedelia tomentosa, Bl.—Rather frequent along the outskirts of the tropical forests of Kamorta; Katchall (g. c.).

384. Croton argyratum, Bl.—Not unfrequent in the tropical forests of Kamorta.

385. Mallotus acuminatus, Muell. Arg.—Common in the coral-reef-forests of Katchall; Great Nicobar (Novara 200; Jelinek 221 & 217—*ungakab*, inc.).

386. Mallotus Helferi, Muell. Arg.—Trice, Track, or Meroe (g. c.).

387. Mallotus muricatus, Muell. Arg.—Frequent in the coral-reef-forests of Katchall; Kamorta (g. c.).

388. Macaranga tanarius, Muell. Arg. (*M. molliuscula*, Kurz in Journ. As. Soc. Beng. 1873. 245).—Frequent in the beach-forests of Kamorta and Katchall; Nankowry (Novara 197; Jelinek 150—*kendub*, inc.); *kángyua*, inc. Katch.

389. Macaranga gigantea, Muell. Arg.—Common in the tropical forests of Kamorta.

390. Alchornea Javensis, Muell. Arg.—Common in the coral-reef-forests of Katchall; Karnicobar (Novara 202; Jelinek 52—*kamfata*, inc.).

391. Alchornea tilliæfolia, Muell. Arg.—Karnicobar (g. c.).

N. B. Diedrichsen gives *Acalypha* as a Nicobarese plant.

392. Cheilosa montana, Bl. var.—Nankowry (Novara 164; Jelinek 175—*majab*).

393. Ricinus communis, L.—Frequent and like wild in the beach-forests of Kamorta and Katchall, entering also the coral-reef-forests; Great Nicobar (Jelinek—*ma*, inc.); *máh*, inc. Katch.

*394. Manihot utilissima, Pohl.—Nicobars (*teste* D.).

395. Gelonium lanceolatum, Willd.—In the coral-reef-forests of Katchall; Karnicobar (Novara 207; Jelinek 12—*liussoldova*, inc.).

396. Gelonium bifarium, Roxb.—Karnicobar (Novara 206 & 208; Jelinek 12—*liussoldova*, inc.).

397. Claoxylon longifolium, Muell. Arg.—A small tree not unfrequent in the tropical and beach-forests of Kamorta and Katchall; *lanú án*, inc. Katch.

398. Claoxylon molle, Endl.—Frequent in the beach-forests of Kamorta and Katchall, entering the tropical forests; Nankowry (Novara 203; Jelinek 149—*enghoye*, inc.).

399. Excœcaria Agallocha, L.—Frequent in the tidal and beach-forests of Kamorta.

400. Excœcaria oppositifolia, Jacq.—Great Nicobar (Novara 194; Jelinek 246—*fugh*, inc.).

401. Excœcaria rectinervis (*Actephila rectinervis*, Kurz in Trim. Journ. Bot. 1875. 329).

Descriptioni (l. c.) adde: folia integerrima, obtusissima v. retusa, rarius apiculata; flores masculi sessiles, diandri, solitarii in axillis bractearum obcordatarum et in spicam sessilem glabram petiolo breviorem aggregati; spicæ omnino masculæ v. basi 2—3 floribus feminibus brevissime pedicellatis auctæ; ovarium trigono-ovatum, glabrum, stylis 3 crassis reflexis coronatum; capsulæ maturæ pedunculo glabro c. semipollicari suffultæ, globoso-trigonæ, cerasi magni magnitudine, crustaceæ, læves; semina subglobosa, pisi minoris magnitudine, pallida, ferrugineo-tigrina et maculata.—Speciei precedenti affinis.

Common on coral-rocks in the tropical forests of Katchall; Tilangchong (Novara 192 & 199; Jelinek 100).

402. Euphorbia parviflora, L., var. linearifolia.—Here and there on the grass-heaths of Kamorta.

403. Euphorbia Atota, Forst.—Common on the beaches and in the

beach-forests of the western coast of Katchall; Great Nicobar (g. c.); Karnicobar (Novara 191; Jelinek 86—*mupee*).

404. Euphorbia pilulifera, L.—A weed around habitations in the beach-forests and uncultivated parts of Kamorta and Katchall.

405. Euphorbia epiphylloides, Kurz in Journ. As. Soc. Beng. 1873, 247.—Karnicobar and Great Nicobar (g. c.).

URTICACEÆ.

406. Elatostema Novaræ, nov. sp.

Fruticulosa, ramosa, glabra; folia alterna, oblique lanceolata v. ovato-lanceolata, basi inæquilaterali acuta, triplinervia, subsessilia, subulato-acuminata, repando-serrata, membranacea, nigrescentia, 3—6 poll. longa, glabra, striis linearibus sparsis adpressis obducta, nervis lateralibus non procul a margine ipso confluentibus; stipulæ subulatæ, 2—3 lin. longæ, deciduæ; flores subglabri, iis *E. lineolati* similes, in axillis foliorum glomerati.—Nankowry (Novara 63; Jelinek 169).

Near *E. lineolatum*, but differs at once by the nigrescent leaves, different nervation, and smaller flowers and flower-clusters.

407. Elatostema integrifolium, Wedd.—Katchall (g. c.).

408. Pellionia procridifolia, Kurz in Trim. Journ. Bot. 1875, 330.—Rather frequent in the coral-reef-forests of Katchall.—Very near to *P. frutescens*, which is a hill-species and has serrate leaves.

409. Villebrunnea sylvatica, Bl.—Not unfrequent in the tropical forests of Kamorta.

410. Pipturus velutinus, Wedd.—Trice and Track (Novara 65; Jelinek 183—*njiha*, inc.); Nankowry (Novara 64; Jelinek 154—*kenpei-hrinê*, inc.).

N. B. Diedrichsen enumerates *Boehmeria* also.

411. Gonostegia hirta, Miq.—Rather frequent along swampy rivulets on the grass-heaths of Kamorta.

412. Pouzolzia Indica, Gaud.—Not unfrequent along swampy rivulets on the grass-heaths of Kamorta.

N. B. *Parietaria* of Diedrichsen's list will probably be the above.

413. Conocephalus sp.—Nicobars (*teste* D.).

*414. Artocarpus incisa, L.—Cultivated on Karnicobar.

415. Artocarpus integrifolia, L.—Cultivated; and I met with a batch of really wild trees in the tropical forest north of the settlement on Kamorta.

416. Artocarpus pomiformis, T. et B. in Nat. Tydschr. Ned. Ind. XXIV. 306.—Rather frequent in the coral-reef- and tropical forests of Kamorta and Katchall.

417. Artocarpus peduncularis, Kurz in Trim. Journ. Bot. 1875, 331.—Rather frequent but dispersed in the tropical forests of Kamorta.

418. Artocarpus chaplasha, Roxb.—Nankowry (Novara 60; Jelinek 165—*pajal*, inc.).

419. Ficus retusa, L.—Common in the coral-reef- and tropical forests of Kamorta and Katchall; Trice and Track (g. c.); Karnicobar (Novara 52; Jelinek 21—*keljue*, inc.); Nankowry and Pulu Milu (Novara 62 and 51; Jelinek 124 and 205—*pong*, inc.); *bong*, inc. Katch.

420. Ficus Indica, L.—Not unfrequent in the tropical and coral-reef-forests of Kamorta and Katchall.

421. Ficus infectoria, L.—Katchall (g. c.).

422. Ficus Rumphii, Bl.—In the tropical forests (calcareous) of the eastern coast of Katchall; Great Nicobar (Novara 59; Jelinek 268).

423. Ficus gibbosa, Bl.—Frequent in the tropical forests of Kamorta; Karnicobar (Novara 61; Jelinek 53—*tajimiyi*, inc.).

424. Ficus chrysocarpa, Rwdt.—In the tropical forests of Kamorta, rather rare.

425. Ficus hispida, L. f.—Common in the beach-forests, rare in the coral-reef-forests, of Katchall and Kamorta; Karnicobar (Novara 58; Jelinek 44—*hambam*, inc.).

426. Ficus pedunculata, Rwdt.—A large tree on Nankowry (Novara 53; Jelinek 167—*lanob*, inc.).

427. Ficus macropoda, Kurz in Pegu Rep. A. 123 and B. 86.—Karnicobar (Novara 54; Jelinek 68—*tessamoa*, inc.); Nankowry (Novara 56; Jelinek 142—*komipuë*, inc.); Great Nicobar, very common (Novara 55; Jelinek 227—*inguë*, inc.).

428. Streblus asper, Lour., var. foliis magis minusve scabris.—Katchall (g. c.), Karnicobar (Novara 201; Jelinek 34—*alang*, inc.).

429. Trema orientalis, Bl., var. velutina (*Sponia velutina*, Planch.). Not unfrequent in the forests of Kamorta.

430. Gironniera subæqualis, Planch.—Rather rare in the tropical forests of Kamorta.

PIPERACEÆ.

431. Chavica macrostachya, Miq. var. ?—On shady coral-rocks, frequent in the tropical forests of Katchall; (Novara 49; Jelinek).

432. Chavica Betle, Miq.—Cultivated and as wild in the beach-forests of all the islands; (Novara 48; Jelinek).

CASUARINEÆ.

433. Casuarina equisetifolia, Forst.—Frequent along the coast and on the beaches of Kamorta and the western side of Katchall; enters the grass-heaths of Kamorta and Karnicobar (Novara 50; Jelinek 6—*mahará*, inc.).

GNETACEÆ.

434. GNETUM GNEMON, L., var. MACROPHYLLA, folia 5—7 poll. longa, $3\frac{1}{2}$—$4\frac{1}{2}$ poll. lata, carnoso-membranacea, laxius reticulata; spicæ androgynæ, simplices, robustiores.—A tree (35—40 + 10—15 + $2\frac{1}{2}$—$3\frac{1}{2}$) rather frequent in the tropical forests of Kamorta; Trice and Track (Novara 46—47; Jelinek 190—*hitoi*, inc.).—Very distinct in appearance from the true *gnemon*, but hardly specifically different.

435. GNETUM MACROPODUM, Kurz in Trim. Journ. Bot. 1875, 331. Very common in the tropical forests of Kamorta.

CYCADEÆ.

436. CYCAS RUMPHII, Miq.—Common in the beach-forests of Kamorta and Katchall; on Kamorta the tree is found on the very ridges in open places of the tropical forests; Karnicobar (Jelinek—*turile* or *tewile*, inc.).

PALMÆ.

437. NIPA FRUTICANS, Wurmb.—Nicobars (*teste* D.).

438. COCOS NUCIFERA, L.—Common in the beach-forests of all the islands, locally ascending calcareous ridges up to 200 feet elevation; *ujóu*, inc. Katch.

439. ARECA CATECHU, L.—Wild in the tropical forests of Kamorta, and apparently also in the coral-reef-forests of Katchall; otherwise everywhere cultivated and like wild; (Novara 43; Jelinek).

440. ARECA AUGUSTA, Kurz in Trim. Journ. Bot. 1875, 170.—Common in the tropical forests of Kamorta, Trinkut, and Nankowry,

441. ORANIA NICOBARICA, Kurz in Trim. Journ. Bot. 1875. 331. t. 171.—Common in the tropical forests of Kamorta.

442. ZALACCA sp. sterile only.—An erect rattan, apparently of this genus, is frequent in the tropical forests of Katchall.

443. KORTHALSIA SCAPHIGERA, Mart.—Great Nicobar (Novara 40; Jelinek 244—*schamoa*, inc.).

444. CALAMUS ANDAMANICUS, Kurz in Journ. As. Soc. Beng. 1874, 211, t. 27—28.

Drupæ maturæ globoso-ovoideæ, cerasi minoris magnitudine, acumine brunneo-squamato terminatæ; squamæ trapezoideæ, crustaceæ, stramineæ, nitidæ, anguste brunneo-marginatæ, convexiusculæ, medio vix impressæ, in appendicem pallidam membranaceam ciliatam squamæ longitudine v. breviorem prolongatæ; semen ovoideo-semiteres, dorso parce at grosse lacunosum; albumen homogeneum.

The drupes described and figured by me (l. c.) turn out not to have been quite ripe, and hence it is that the seed is represented with the

markings of the scales. Fully ripe drupes present a very different appearance from the figures given, the scales being much exserted and developed and of a straw-colour, and the appendages turning quite pale-coloured.—Common in the tropical forests of Kamorta; Karnicobar (Novara 41—42; Jelinek—*maätje*, inc.).

445. CALAMUS sp.—Rare in the tropical forests of Kamorta.

It is a small species with green prickly sheaths and broad pinnæ. I possess only the female flowers and am therefore unwilling to describe it as a new species. There are several other species of *Calamus* on these islands, but they were out of flower or fruit.

PANDANEÆ.

446. PANDANUS LERAM, Jones.—Common in the tropical and coral-reef-forests of all the islands, delighting chiefly in and along jungle-marshes; *ladong*, inc. Katch.

N. B. Habit and affinity of *P. dubius*, Spreng., but shorter stemmed and more branched; the stigmas are auricular-orbicular, as large as in *P. dubius*, sessile, and somewhat waved on the margins.

447. PANDANUS ODORATISSIMUS, L. f.—Frequent on the beaches and in the beach-forests of Kamorta and Katchall; on Kamorta it forms a principal feature on the grass-heaths.

N. B. Junghuhn (Java. I. 2nd germ. ed. 109 sqq.) has already remarked upon and illustrated the great variability in habit of the screw-pines. The form which grows along the beaches forms arboreous ascending shrubs, much branched and sending down quite a labyrinth of straight aerial roots; but the one which grows on the heaths is entirely different, being a small tree from 20 to 25 feet in height with a stout grey simple stem, which sends down short and thick aerial roots from the lowermost part only, while the crown is small, sparingly and shortly branched, and very dense. There are, besides, two varieties of these trees on the heaths, the one having the stigmas normal as in the littoral form and the drupes connate high up so as to effect a tesselated appearance, while the other variety has the drupes free for about one-fourth of their length from the top terminating in short erect points, on the inner face of which the linear-lanceolate stigmas are situated. The foliage in the one is darker green, but the male flowers of both varieties are exactly the same. Dr. Hance (in Trim. Journ. Bot. 1875, 68.) has remarked upon the variability of the stigmas in screw-pines, but overlooked that I had myself pointed out this fact (Journ. Bot. 1867. 99.) with the qualification that they vary without therefore giving up their essential value. The stigmas ought to be described from the ovaries or the young drupes but it is difficult to collect such; it is usually only after the syncarps have attained some size that they catch the eye.

The male organs appear to me to be of much higher value in grouping the species of *Pandanus*, but the time has not yet arrived when these organs shall be available of all or even of most of the species. *Pandanus helicopus* was correctly placed by me in the section *Rykia*, as I find on re-examination of my material, and I have also since obtained the male spadices of it, which shew racemose anthers.

448. Freycinetia insignis, Bl.—In the tropical forests of Katchall and Kamorta (also Andamans).

449. Freycinetia scandens, Gaud. ?—Common in the tropical and coral-reef-forests of Katchall and Kamorta; Pulu Milu (Novara 39; Jelinek 197—*jï*, inc.). It is very doubtful whether this is really the same as Gaudichaud's plant, and it is possible that it may be only the young state of the preceding species, although I met with no intermediate states.

AROIDEÆ.

450. Homalonema aromaticum, Schott.—Common in the tropical forests of Kamorta; Pulu Milu (Novara 34; Jelinek 201—*lamany*, inc.).

451. Chamæcladon ovatum, Schott ?—Great Nicobar (Novara 33; Jelinek 280).—Schott's description agrees with the Nicobar plant except in some minor points. I have seen no authentic specimens of the Singapore plant.

452. Aglaonema simplex, Bl.—Not unfrequent in the coral-reef- and tropical forests of Katchall and Kamorta; Pulu Milu (Novara 32; Jelinek 196—*lakoa*, inc.).

N. B. *Aglaonema palustris*, T. et B. in Tydsch. Nat. Ver. Ned. Ind. XXIV. 305, = *Aglaodorum Griffithii*, Schott.

453. Colocasia virosa, Kth.—Very plentiful, in company with *Nephrodium propinquum*, along a swampy rivulet on the grass-heaths of Kamorta.

*454. Colocasia antiquorum, Schott.—Frequently cultivated by the Nicobarese.

455. Pothos scandens, L.—Common in all forests of all the islands; Great Nicobar (Novara 37 & 38; Jelinek 233—*tamab*, inc.).

456. Scindapsus pteropodus, T. et B. in Nat. Tydsch. Ned. Ind. XXV. 407.—Great Nicobar (Novara 35; Jelinek 276).

LEMNACEÆ.

457. Lemna paucicostata, Hegelm.—Western side of Katchall, in a jungle-marsh behind Katjui.

NAJADACEÆ.

458. Cymodocea sp. ?—Common around Katchall and forming submarine meadows on the coral-reefs at a depth of 2—4 fathoms.

N. B. Diedrichsen has *Zostera* in his list of Nicobar plants.

459. HALOPHILA OVALIS, Hf.—Rather frequent, along with other pelagic phanerogams, on the submarine coral-reefs around Katchall.

460. ENHALUS ACOROIDES, Stend.—Forming submarine meadows and attaining a length of 4 feet in the shallows around all the islands. Prefers especially debouchures of freshwater-rivers. On the coral-reefs of Katchall there occurs in masses what appears to be a small form of this species which has the leaves never above 6 inches long.

461. NAJAS sp.—In water-holes of the jungle-marshes behind Katjui, on the western coast of Katchall. (The specimens had been too much ransacked by pigs from the village to enable me to procure more than the tips of the plants).

462. BLYXA ROXBURGHII, Rich.—Here and there in the rivulets on the grass-heaths of Kamorta.

SCITAMINEÆ.

463. ALPINIA PHŒNICEA, Kamphœvener MS.—Nicobars *(teste* D.).

464. AMOMUM (DYMCZEWICZKIA) FENZLII, nov. sp., Plate XII.

Herba perennis, sobolifera, elata, 5—7 ped. alta, glaberrima ; folia 2—3-pedalia, lineari-oblonga, subabrupte acuminata, basi inæquali in petiolum 3—4 lin. longum attenuata, glaberrima, subcoriacea ; vaginæ ore valde productæ ; flores pro genere minusculi, inter squamas et squamulas glabras villoso-marginatas sessiles et capitulum magnum lato-involucratum hemisphericum formantes ; pedunculus usque semipedalis laxe et ample bracteatus ; bracteæ oblongæ ad ovato-oblongæ, $1\frac{1}{2}$—2 poll. longæ, glabræ, rosellæ v. albidæ, vulgo villoso-ciliatæ ; bracteæ involucrantes lato-ovales, obtusissimæ, 1—$1\frac{1}{2}$ poll. longæ, pallide roseæ, glabræ, marginibus lanato-villosæ ; calyx tubulosus, apice 3-fidus v. 2-fidus cum lobo altero latiori et bilobulato, extus parce adpresse sericeo-pilosus ; corolla $1\frac{1}{2}$ poll. longa, tubo semipollicari intus usque ad medium villoso extus parce piloso ; perigonii lobi pallide rosei, concavo-lineares, pollicem circiter longi, marginibus parcissime pilosi, rectiusculi, apice cucullato sæpius penicillati ; labellum equilongum, extus basin versus parce sericeum, trapezoideo-ovatum, concavum et genitalia omnino includens, basi attenuatum, subtiliter radiato-nervosum, coccineum, marginibus niveum ; anthera inappendiculata, apice emarginata, basi marginibus barbata ; filamentum planum, intus villosum ; stylus sursum parce pilosus et leviter incrassatus ; stigma oblique capitatum ; staminodia 2, oblique oblonga, carnosa, apice ciliolata et passim biloba ; baccæ obovoideæ, pollicem circiter longæ, perigonii tubo coronatæ, hirsutulæ ; semina obovoidea, atra, albo-arillata.—Frequent in the tropical forests of Kamorta.

MARANTACEÆ.

465. Maranta dichotoma, Wall (*M. grandis*, Miq. Suppl. Fl. Sum. 616).—Frequent in the shade of the tropical forests of Kamorta; Katchall (g. c.); Nankowry (Novara 30; Jelinek 152—*ofu*, inc.).

466. Canna sp.—Nicobars (*teste* D.).

MUSACEÆ.

*467. Musa sapientum, L.—Cultivated at the Penal Settlement of Kamorta. Whether the variety of the plantain cultivated by the Nicobarese belong to this species or to *M. simiarum* I am unable to say.

468. Musa Simiarum, Rumph. ?—The plants growing in the forests of Kamorta were out of flowers and hence are doubtfully referred to this species.

ORCHIDEÆ.

469. Oberonia sp.—On trees of the tropical forests of Kamorta, not rare (specimens lost).

470. Dendrobium anceps, Sw.—Common on trees in the mangrove- and beach-forests of Kamorta and Katchall.

471. Dendrobium crumenatum, Sw.—Frequent on trees in the beach- and mangrove-forests.

472. Dendrobium sp.—On trees on the grass-heaths of Kamorta.—Flowers exactly like those of *D. crumenatum*, but the leaves short, rigidly coriaceous, horizontal or half-erect, and distichous. Probably only an erect variety produced by abundance of light.

473. Pholidota imbricata, Sm.—Rare on trees in the tropical forests of Kamorta.

474. Pachystoma senile, Reichb. f.—Very common on the grass-heaths of Kamorta and sometimes producing quite a rose-coloured tint over large tracts of them. The flowers are here all rose-coloured, while in Bengal they are as constantly white.

475. Eulophia Andamanensis, Rchb. f. in Flora 1872. 276.—Rare on dry places near the mangrove-swamps and also in the drier parts of the swamps themselves, along the western coast of Katchall.

476. Eulophia graminea, Ldl.—In patches dispersed over the grass-heaths of Kamorta.

477. Eulophia decipiens, nov. sp., Pl. XIII, Figs. 8—12. Herbæ erectæ, tuberosæ, glaberrimæ, 2—3 ped. altæ; folia ignota, hysteranthia; scapus erectus, simplex, albidus, squamis parvis lanceolatis internodiis multoties brevioribus vestitus, glaberrimus; flores majusculi, albi, glaberrimi, pedicellis gracilibus 3—4 lin. longis glabris suffulti et secundi, bracteis minutis 2 lin. circiter longis sustenti; perigonii phylla exteriora et interiora 2 superiora linearia, vix falcata, 5-nervia, ½ poll. longa, acuta, gla-

bra; labellum concavo-obovatum, basi in calcar lineam fere longum graciliter saccatum desinens, supra medio 3-lobatum, lobo medio multo majore obtuso et sæpius mucronulato, marginibus crispulum, nervis basi 5, sursum circiter 10—12, longitudinalibus percursum quarum 4—5 in lobum majorem excurrunt et in fibrillas carnosas numerosas excrescunt; columna gracilis, recta, latiuscula, sepalorum dimidium vix attinens.—Here and there socially on the grass-heaths of Kamorta.

The plant, and indeed the structure of the flowers themselves, so closely resembles *Pachystoma senile* that I considered it for a while to be a perfectly glabrous form of it (*P. senile* having the flowers and pedicels all minutely puberulous), but it has short bracts, and the pollinia assign it to *Eulophia*.

478. Cyrtopera fusca, Wight?—A few plants only among long grass along a swampy rivulet west of Enaca, Kamorta.

479. Phalænopsis cornu-cervi, Bl. et Reichb. f.—Here and there on trees in the tropical forests of Kamorta.

480. Trichoglottis quadricornuta, nov. sp., Pl. XIII, Figs. 1—7.

Multicaulis, epiphytica, glabra, caulibus pendulis vaginis sulcato-striatis obductis; folia alterna, disticha, lineari-lanceolata, basi torta attenuata, subsessilia, acuminata, coriacea, in sicco 13—14-nervia, 2—3½ poll. longa; flores majusculi, oppositifolii, flavi?, 2-ni v. raro 3—4-ni fasciculati, pedicellis arcuatis ½ poll. fere longis sustenti; perigonii phylla exteriora obovato-oblonga, obtusa, circ. ⅓ poll. longa, lateralia subfalcata; phylla interiora 2 superiora conformia sed angustiora; labellum valde arcuatim inflexum, supra basi inæqualiter 4-cornutum, cornubus 2 posticis loborum locum tenentibus lineam fere longis acutiusculis, 2 basilaribus duplo brevioribus, intra cornua callo concavo hirsutissimo auctum et in lobum reflexo-arcuatum crassum linearem subtus apicem versus unicallosum apice breviter bifido lævem excurrens; calcar rectiusculum, obtusiusculum, lobo medio paullo longius; columna brevissima; pollinia 2, globosa, apice in semipollen parvum ellipsoideum in cavitate pollinis insidens separabilia.

Frequent in the tropical forests of Kamorta; (Novara 28; Jelinek).

481. Luisia sp.—Frequent on trees in the beach-forests of Kamorta and Katchall. Leaves only.

482. Vanda teres, Ldl.?—Karnicobar (g. c.). Leaves only.

483. Saccolabium obliquum, Ldl.—Common in the coral-reef and tropical forests of Katchall and Kamorta; (Novara 29; Jelinek). Flowers small, yellow, the lip whitish.

484. Thrixspermum amplexicaule, Rchb. f. in Flora 1868. 53. (*Aërides amplexicaule*, Ldl.).—Only a single plant met with amongst long grass and shrubbery along a swampy rivulet west of Enaca, Kamorta. (In Java it grows amongst shrubbery on *dry* grounds).

485. Corymbis disticha, Ldl.—Rare in the tropical forests on the plutonic hills of Ho Ho, Kamorta. Trice and Track (g. c.).

N. B. Living specimens of from 15 to 18 other species of orchids were collected by me, but most of these were lost or otherwise made away with.

BROMELIACEÆ.

486. Ananas sativus, Schult.—Cultivated on the islands and producing superior fruits.

AMARYLLIDEÆ.

487. Crinum Asiaticum, L.—Common in the beach-forests of Kamorta and Katchall; Karnicobar (Novara 27; Jelinek 87—*faa*, inc.).

488. Hypoxis orchioides, Kurz in Miq. Ann. Mus. Lugd. Bat. IV. 177.—(*Curculigo ensifolia*, R. Br. Prod. 290; Bth. Fl. Austr. VI. 448).—Only a single specimen seen on the grass-heaths of Kamorta.

489. Molineria capitulata, Herb. Amaryll. 84 (*Leucojum capitulatum*, Lour. Fl. Coch. 246; *Molineria recurvata*, Herb. Amar. 84; Kurz in Miq. An. Mus. Lugd. Bat. IV. 175).—Nankowry (Novara 31; Jelinek 171—*tetokom*, inc.).

DIOSCOREACEÆ.

490. Dioscorea glabra, Roxb.—Frequent in the tropical forests of Kamorta; Great Nicobar (Novara 26; Jelinek 231—*wuën*, inc.).

LILIACEÆ.

491. Dracæna angustifolia, Roxb.—Great Nicobar and Trice and Track (g. c.).

492. Dracæna linearifolia, Miq. (*D. Finlaysoni*, Baker in Journ. Linn. Soc. XIV. 525).—Very common in all the forests, but more so in the beach- and coral-reef-forests, of Kamorta and Katchall; (Novara 25; Jelinek); *na-el*, inc. Katch.

493. Dracæna Griffithii, Reg.—A tree 20 ft. high, rather rare in the tropical forests of Kamorta.

494. Dracæna spicata, Roxb.—Kondil and Karnicobar (g. c.).

495. Smilax polyacantha, Wall.—Common in the tropical forests of Kamorta.

496. Flagellaria Indica, L.—Common in the beach- and tidal forests of all the islands; Great Nicobar (Novara 24; Jelinek 242—*paläï*, inc.).

MELANTHACEÆ.

497. Stemona sp. (Roxburghia).—Nicobars (*teste* D.).

COMMELYNACEÆ.

498. Aneilema ensifolium, Wight.—Here and there, especially along swampy rivulets, on the grass-heaths of Kamorta, more frequent in the northern parts.

499. Aneilema nudiflorum, R. Br.—Amongst grass along a rivulet on the grass-heaths of Kamorta.

500. Commelyna communis, L.—Frequent in the beach-forests of Kamorta, also in shrubbery near the old cattle-shed of the settlement on Kamorta.

N. B. Dr. Diedrichsen enumerates *Tradescantia.*

RESTIACEÆ.

501. Eriocaulon longifolium, NE.—Not unfrequent along swampy rivulets of the grass-heaths of Kamorta.

502. Eriocaulon truncatum, Ham.—Along a marshy rivulet on the grass-heaths of Kamorta.

CYPERACEÆ.

503. Kyllingia monocephala, Rottb.—Frequent everywhere, in the forests as well as in cultivated lands, around habitations, etc.; Great Nicobar (Novara 18; Jelinek 216—*kons* (*ch*) *ea*, inc.).

504. Remirea maritima, Aubl.—Locally on the beaches of Kamorta.

505. Cyperus polystachyus, Roxb. and the variety *C. strictus*, Roxb.—Both pretty frequent on the grass-heaths of Kamorta.

506. Cyperus vulgaris, Kth.—Here and there along the swampy rivulets on the grass-heaths of Kamorta.

507. Cyperus Haspan, L.—Not unfrequent along marshy rivulets on the grass-heaths of Kamorta.

508. Cyperus Iria, L.—Locally along swampy rivulets on the grass-heaths of Kamorta.

509. Cyperus mœstus, NE.—Not unfrequent in the tropical and coral-reef-forests of Kamorta and Katchall.

510. Cyperus pilosus, Vhl.—Here and there along swampy rivulets on the grass-heaths of Kamorta.

511. Cyperus canescens, Vhl.—Nicobars (Novara 22 and 23; Jelinek and Hochstetter).

512. Cyperus dilutus, Vhl.—Rather frequent on the grass-heaths of Kamorta, and more especially in swampy grounds of the valleys.

513. Cyperus umbellatus, Bth. and var. leucostachya, spiculis niveis, erectiusculis, radiis brevibus satis congestis.—The white-spiked variety rather frequent in the beach- and coral-reef forests of Katchall; the typical form on Tillangchong (Novara 21; Jelinek 98).

514. Scirpus subulatus, Vhl. (*S. pectinatus*, N. E.).—Nicobars (*teste* Vahl).

515. Isolepis sp.—Locally but socially on barren ground of the grass-heaths of Kamorta.

516. Fimbristylis miliacea, Vhl.—Frequent along swampy rivulets on the grass-heaths of Kamorta.

517. Fimbristylis complanata, Lk.—Not unfrequent along swampy rivulets on the grass-heaths of Kamorta.

518. Fimbristylis diphylla, Vhl.—Frequent in the grass-heaths of Kamorta especially along rivulets.

519. Fimbristylis ovalis, NE. and a densely villous variety of it. The glabrous form common on the grass-heaths of Kamorta, the villous form only along one of the numerous rivulets, growing almost in the water.

520. Fimbristylis nutans, Vhl.—Not rare along a rivulet on the grass-heaths of Enaca, Kamorta.

521. Fimbristylis globulosa, Wall.—Locally along swampy rivulets on the grass-heaths of Kamorta.

522. Fuirena umbellata, Rottb.—Locally along marshy rivulets on the grass-heaths of Kamorta.

523. Anosporum cephalotes (*Cyperus cephalotes*, Vahl.).—Nicobars (*teste* Vahl).

524. Hypolythrum latifolium, Rich.—Not unfrequent in the tropical forests of Kamorta.

525. Hypolythrum trinervium, Kth.—Great Nicobar (Novara 16; Jelinek 226—*timinjhai* inc.).

526. Rhynchospora gracillima, Thw. Ceyl. Pl. 435.—Common along a swampy rivulet on the grass-heaths west of Enaca, Kamorta.

527. Rhynchospora aurea, Vhl.—Not unfrequent along swampy rivulets on the grass-heaths of Kamorta.

528. Rhynchospora Wallichiana, Kth.—Common on the dry grass-heaths of Kamorta.

NB. Diedrichsen gives the genus *Diplacrum* as a Nicobar plant, but to judge from some of his remarks thereon, this cannot be correct.

529. Scleria lateriflora, Boeck., var. glabra.—In a swampy dell on the grass-heaths west of Enaca, Kamorta.

530. Scleria lithosperma, Willd.—Here and there in open places of the tropical forests of Kamorta; Katchall (g. c.).

531. Scleria Sumatrensis, Retz.—Common on the grass-heaths, but also in open places, along paths, etc., in the tropical forests of Kamorta.

532. Scleria sp. nov. allied to the preceding. Frequent in the grass-heaths of Kamorta.

NB. Unfortunately, I have only brought away a single incomplete specimen of this interesting form, having mistaken it at the time for a variety only of the preceding.

533. SCLERIA LÆVIS, Retz. Not unfrequent along swampy rivulets on the grass-heaths of Kamorta.

534. CAREX LONGIARISTATA, Boott.—Tillangchong (Novara 20; Jelinek 90).

GRAMINEÆ.

535. PASPALUM SCROBICULATUM, L.—Frequent in cultivated and uncultivated places around the penal settlement of Kamorta, often also along rivulets in the grass-heaths.

536. PASPALUM FLEXUOSUM, Klein.—Here and there in moist grassy spots along rivulets on the grass-heaths of Kamorta.

537. PASPALUM CONJUGATUM, Retz.—Frequent in grass-lands around the settlement and around habitations in the beach-forests of Kamorta.

538. DIGITARIA sp. *(Panicum filiforme,* Roxb., vix L.), with a quite glabrous variety.—Common on the grass-heaths and in the beach-forests of Kamorta; the pilose form around the huts of the natives on Katchall.

539. OPLISMENUS COMPOSITUS, L.—Frequent in the tropical forests, but found also in the coral-reef- and beach-forests of Kamorta and Katchall; (Novara 3; Jelinek).

540. PANICUM GLAUCUM, L.—Here and there on the grass-heaths of Kamorta.

N. B. Dr. Diedrichsen enumerates *Pennisetum* as Nicobarese.

541. PANICUM COLONUM, L.—Here and there along swampy rivulets on the grass-heaths of Kamorta.

542. PANICUM JAVANICUM, Poir.—Karnicobar (Novara 1; Jelinek 70—*kujop,* inc.).

543. PANICUM FILIPES, NE.—Locally in the tropical forests of Kamorta; Pulu Milu (Novara 2; Jelinek 199—*objuab,* inc.).

544. PANICUM HUMILE, NE.—Locally frequent in the dry grass-heaths of Kamorta.

545. THYSSANOLÆNA ACARIFERA, NE.—Not unfrequent in open or cleared spots in the tropical forests of Kamorta; Nankowry (Novara 5; Jelinek 135—*petal,* inc.); Karnicobar (Novara 4; Jelinek 28).

546. ISACHNE MYOSOTIS, NE.—Rare along a rivulet on the grass-heaths west of Enaca, Kamorta.

547. ISACHNE sp. (near *Panicum miliare,* L. but certainly different).—In a swampy rivulet on the grass-heaths west of Enaca, Kamorta.

548. ISACHNE MILIACEA, Roth., var.? HUMILIS, more slender, usually 6—8 in. high, the spikelets nearly half the size.—Frequent in swampy rivulets of the grass-heaths of Kamorta.

549. Thouarea sarmentosa, Pers. *(Ornithocephalochloa arenicola,* Kurz in Trim. Journ. Bot. 1875, 332, t. 171, fig. 1—18, *teste* Oliver).—Creeping on the sand of the beaches of the western coast of Katchall; *tsigal,* inc. Katch.

550. Centotheca lappacea, P. B.—Frequent in the beach-, coral-reef, and tropical forests of Kamorta and Katchall; Trice and Track (Novara 9; Jelinek 187—*upjuab,* inc.).

551. Sporobolus sp.—Nicobars (*teste* D.).

552. Arundo Roxburghii, Kth.—Frequent along marshy rivulets of the grass-heaths of Kamorta; Karnicobar, on a swampy grass plain on the northern coast (Novara 6 and 7; Hochstetter and Jelinek 16—*tap,* inc.).

553. Eleusine Indica, Gærtn.—Frequent in the beach-forests, and around habitations, of Kamorta and Katchall; also here and there on the grass-heaths.

554. Dactyloctenium Ægyptiacum, Willd.—Here and there on the grass-heaths of Kamorta.

555. Cynodon Dactylon, Pers.—Frequent in the grass-heaths of Kamorta, and very common around the penal settlement, where it has been sown.

556. Eriachne Chinensis, Hance.—A conspicuous constituent of the grass-heaths of Kamorta.

557. Eragrostis unioloides, P. B.—Here and there on the grass-heaths of Kamorta.

558. Eragrostis Zeylanica, NE.—Common on the grass-heaths of Kamorta.

559. Eragrostis plumosa, Lk.—Around the huts of the natives in the beach-forests of the eastern coast of Katchall; Great Nicobar (Novara 8; Jelinek 237).

560. Manisuris sp.—Nicobars (*teste* D.).

561. Sorghum muticum, NE.—Common on the grass-heaths of Kamorta, growing especially luxuriantly along the outskirts of the forests.

562. Chrysopogon aciculatus, Trin.—Not unfrequent on the dry grass-heaths of Kamorta.

563. Heteropogon contortus, L.—Common on the dry grass-heaths of Kamorta.

564. Spodiopogon sp. (villous).—Frequent along swampy rivulets on the grass-heaths of Kamorta.

565. Spodiopogon sp. (quite glabrous).—Karnicobar (Novara 14; Jelinek 76—*vió,* inc.).

566. Schizachyrium brevifolium, NE.—Here and there along steep slopes on the grass-heaths of Kamorta.

567. Ischæmum muticum, L.—Common on the beaches and in the beach-forests of all the islands; north coast of Karnicobar (Novara 12 and

13; Hochstetter and Jelinek 29 and 61—*kijop, keljii*, or *tscheljii*, inc.); *auk yu ap*, inc. Katch.

568. Imperata arundinacea, Cyr.—Locally common on the dry grass-heaths of Kamorta.

*569. Saccharum officinarum, L.—Only cultivated by the natives.

570. Saccharum spontaneum, L.—Karnicobar, covering large tracts on the northern side (Novara 11; Hochstetter).

571. Dimeria sp.—Here and there on the dry grass-heaths of Kamorta, but the specimens were too old and withered for identification.

572. Bambusa vulgaris, Ræusch.—Malacca on Nankowry, probably cultivated.

573. Dinochloa Andamanica, Kurz.—Common in the tropical and coral-reef-forests of Kamorta and Katchall; Great Nicobar (Novara 10; Jelinek 259—*komeha*, inc.).

LYCOPODIACEÆ.

574. Lycopodium phlegmaria, L.—On trees of the tropical forests of Kamorta.

575. Lycopodium laxum, Prsl.—Rare in the tropical forests of Kamorta.

576. Lycopodium cernuum, L. (the variety *L. curvatum*, Sw.). Frequent on the grass-heaths of Kamorta.

577. Selaginella caudata, Spring.—Common in the tropical forests of Kamorta and Katchall.

578. Selaginella flabellata, Sprg.—Nicobars (*teste* Sprengel).

579. Selaginella tenella, Spring. (*S. imbricata*, John Scott in Journ. Agri. Hort. Soc. Ind. 1868, 260, non Spring.).—Not unfrequent along shady slopes on the grass-heaths of Kamorta.

FILICES.

580. Gleichenia dichotoma, Willd.—Common on the grass-heaths of Kamorta.

581. Alsophila albo-setacea, Bedd. in litt. (*A. Mertensiana*, Metten. in Fenzl Reis. Novar. Bot. I. 221, non Kunze).—Here and there in the tropical and coral-reef-forests of Kamorta and Katchall; P. Milu (Novara—Jelinek—*latong*, inc.).

582. Trichomanes Javanicum, Bl.—Here and there along rocky rivulets in the tropical forests of Kamorta.

583. Trichomanes humile, Forst.—Nicobars (Novara).

584. Trichomanes Filicula, Bory.—On mossy trees, not unfrequent in the coral-reef-forests of Katchall.

585. Trichomanes muscoides, Sw.—On mossy tree-stems, rare in the coral-reef-forests of the eastern coast of Katchall.

586. Davallia Speluncæ, Bak.—Not unfrequent in the tropical and coral-reef-forests of Kamorta and Katchall.

587. Davallia solida, Sw.—Frequent on trees of Kamorta and Katchall.

588. Davallia elegans, Sw.—Nicobars (Novara).

589. Davallia heterophylla, Sm.—Not rare on the trunks of the screw-pines and cocoa-nut-palms in the beach-forests and on the grass-heaths of Kamorta.

590. Davallia parallela, Wall.—Not unfrequent, and especially on cocoa-nut-palms, along the coast of Kamorta and Katchall; also found but scantily on screw-pines of the grass-heaths.

591. Lindsæa lanceolata, Lab.—Here and there on the grass-heaths of Kamorta.

592. Lindsæa tenera, Dry.—Not unfrequent along rocky rivulets in the tropical forests of Kamorta.

593. Adiantum sp.—Nicobars (*teste* D.).

594. Dicksonia sp.—Nicobars (*teste* D.).

595. Pteris longifolia, L.—Nicobars (Novara).

596. Pteris repandula, Lk.—Nicobars (Novara).

597. Pteris pellucens, Hook.—Amongst coral-rocks in the tropical forests of Katchall.

598. Blechnum orientale, L.—Here and there along rivulets on the grass-heaths of Kamorta.

599. Ceratopteris thalictroides, Brongn.—Here and there along swampy rivulets of the grass-heaths of Kamorta.

600. Vittaria elongata, Sw. (and the var. *V. zosteræfolia,* Bory). Rather frequent in the coral-reef and tropical, rarely in the beach-forests, of Katchall and Kamorta.

601. Antrophium callæfolium, Bl.—Not unfrequent in the coral-reef-forests of Katchall.

602. Asplenium Nidus, L.—Common in the tropical and coral-reef-forests of Kamorta and Katchall.

603. Asplenium macrophyllum, Sw.—Frequent in the tropical and coral-reef-forests of Katchall and Kamorta.

604. Asplenium (Diplazium) sp.—Nicobars (*teste* D.).

605. Polypodium phymatodes, L.—Common in the beach-forests of Kamorta and Katchall.

606. Polypodium quercifolium, L.—Frequent on trees of the beach- and tidal forests of Kamorta and Katchall.

607. Polypodium longissimum, Bl.—A few specimens only in bushes along a swampy rivulet in the grass-heaths west of Enaca, Kamorta.

608. Polypodium irioides, Poir.—Nicobars (Novara).

609. Polypodium adnascens, Sw.—Common everywhere in all the forests of Kamorta and Katchall.

610. NEPHROLEPIS ACUTA, Prsl.—Frequent in the coral-reef- and tropical forests of Kamorta and Katchall.

611. NEPHRODIUM DECURRENS, Bak.—Nicobars (Novara).

612. NEPHRODIUM PROPINQUUM, R. Br.—In large quantities along one of the swampy rivulets on the grass-heaths of Kamorta.

613. NEPHRODIUM MOLLE, Desv.—Frequent in the tropical forests of Kamorta.

614. NEPHRODIUM PROLIXUM, Bak.—Not rare in the tropical forests of Kamorta.

615. NEPHRODIUM TRUNCATUM, Bak.—In the tropical forests of Kamorta.

616. GYMNOGRAMME sp.—Nicobars (*teste* D.).

617. STENOCHLÆNA SCANDENS, J. Sm.—Common in all forests of Kamorta and Katchall.

618. ACROSTICHUM AUREUM, L.—Frequent in salt-marshes and tidal and mangrove swamps of all the islands; on Kamorta it frequently recurs along the marshy fresh water rivulets on the grass-heaths.

619. LYGODIUM CIRCINNATUM, Sw.—Common in the tropical forests of Kamorta and Katchall.

620. LYGODIUM SCANDENS, Sw.—Here and there amongst long grass and shrubbery along rivulets on the grass-heaths of Kamorta.

621. LYGODIUM PINNATIFIDUM, Sw.—Not unfrequent amongst long grass and shrubbery along rivulets on the grass-heaths of Kamorta.

622. OPHIOGLOSSUM PENDULUM, L.—Nicobars (Novara).

623. HELMINTHOSTACHYS ZEYLANICA, Hook.—Along a swampy rivulet below the old cattle-shed on the grass-heaths near the settlement on Kamorta; also in the swamp on the island Milu (Diedrichsen).

624. ANGIOPTERIS sp.—Nicobars (*teste* D.).

EXPLANATION OF THE PLATES.

Plate XII. *Amomum Fenzlii.* Fig. 1, flowering scape, nat. size (the bracts are represented by mistake as hirsute: they are glabrous except on the margins); fig. 2, a portion of the stem and leaf, shewing petiole and produced sheath, nat. size; fig. 3, flower, nat. size; fig. 4, ditto, expanded; fig. 5, labellum, slightly enlarged; fig. 6, genitalia and staminodes; fig. 7, anther, from the side; fig. 8, ditto, from behind fig. 9, staminodes; fig. 10, fruit, nat. size; fig. 11, seeds, nat. size; fig. 12, ditto, slightly enlarged.

Plate XIII, Figs. 1—7. *Trichoglottis quadricornuta.* Fig. 1, flowering branch, nat. size; fig. 2, flower from the front; fig. 3, ditto, from behind; fig. 4, dissection of the same; fig. 5, the column and labellum, from the side; fig. 6, labellum; fig. 7, transverse section of the same made between the two pairs of horns.

Figs. 8—12. *Eulophia decipiens.* Fig. 8, flowering plant, nat. size; fig. 9, flower from the front; fig. 10, column and labellum, from the side; fig. 11, labellum; fig. 12, pollinia. (All the figures except figs. 1 and 8 more or less enlarged.)

XI.—*Description of* Golunda Ellioti *from Sind.*

By W. T. Blanford, *F. R. S.*

(Recd. June 28th;—Read August 2nd, 1876).

(With Plate X.)

Amongst a few mammals and reptiles in spirit, collected and given to me by Mr. H. E. Watson of the Sind Commission, are two specimens, one adult, the other young, of a mouse or small rat with very coarse, flat, grooved hairs and the upper incisors sulcated. These mice were obtained on the southern extremity of the Khirthar, a range of mountains which forms the western boundary of Upper Sind, but which enters the province nearly west of Sehwán, and running thence south-south-east, terminates about 40 miles south of Sehwán and rather more than 50 north-west of Kotri. At their southern extremity these hills are 2300 feet high, to the north they are from 4000 to 6000, some peaks being even higher.

The skull of the larger specimen, on being extracted, proves to be of the ordinary murine type, and the only peculiarity is in the characters of the teeth. The upper incisors are grooved, and the molars, instead of being simply tuberculate, as in *Mus*, appear to be formed of deep folds of enamel, as in *Gerbillus* or *Nesokia*, but the form of the folds is widely different from what it is in those genera; each fold consisting of a number of deep lobes or pillars with a nearly semicircular section. Thus the upper surface of the crown of the tooth has a most peculiar reticulated appearance. The semicircular lobes are arranged throughout the teeth in three longitudinal series in the upper, and two in the lower jaw. In older specimens the lobes may run more into each other, but the skull examined is fully adult.

No description or figure, so far as I am aware, of the teeth of any Indian mouse has ever been published exhibiting the peculiarities above described. The published descriptions of the molar teeth in *Leggada* and *Golunda* appear to me to differ materially from those of the specimen from Sind. The incisors in *Leggada* are nowhere said to be grooved, and no mention is made in any of the descriptions of *Golunda* by Gray,* Elliot,† or Jerdon,‡ of flattened or grooved hairs. I unfortunately did not at first examine the specimens of *Golunda Ellioti* in the Indian Museum sufficiently carefully, as the description both of the fur and dentition appeared to me to refer to

* Charlesworth's Mag. Nat. Hist. I, 1837, p. 586.

† Mad. Jour. Lit. and Science, X, 1839, p. 213.

‡ Mammals of India, p. 212.

a very different form. The only murine genus of which I could find a description with dentition resembling that in the Sind species was *Pelomys** of Peters, founded on an African rat from Mozambique. I concluded that the Sind rat was a new species of *Pelomys*, and I proposed to call it *P. Watsoni*. This name was unfortunately published in the Proceedings of the Society for August before I had discovered my mistake.

For this discovery I am indebted to Professor Peters, to whom I sent a sketch of the molars of the Sind rat, which I asked him to compare with those of *Pelomys*. This he did and told me that they agreed. He also called my attention to the circumstance that the coffee-rat of Ceylon, of which he had received a specimen, closely resembled *Pelomys* in its dentition and even in its external characters, and he suggested that the genera *Golunda* and *Pelomys* were identical. Upon this I re-examined the specimens marked *Golunda Ellioti* in the Museum, and to my surprise found that they coincided with mine from Sind; and the skull of one specimen which Dr. Anderson very obligingly allowed to be extracted for me proved identical with that of the Sind rat. I, however, noticed that in these specimens, perhaps because they have been exposed for years, the grooved hairs have split at the ends, and present the appearance of ordinary round or nearly round hairs, so that it is necessary to examine the fur closely in order to detect its peculiarity. I also find that the Sind rat agrees excellently in characters and dimensions with Kelaart's original description,† and that Mr. Blyth‡ has already called attention to the differences between the coffee-rat of Ceylon and the description of the *Gulandi (Mus hirsutus*, Elliot, said to be identical with *Golunda Ellioti*, Gray) given by Mr. (now Sir Walter) Elliot.§ I ought not to have overlooked these facts, but I must say in apology that I do not think any one could have identified the Sind rat from the published descriptions of *Golunda Ellioti*.

Before discussing the synonymy of this rat, I will give a description of the Sind specimen.

Description taken from an adult female specimen preserved in spirit. General colour brown above, the colour not being uniform but a mixture of black and fulvous, dirty white (isabelline) below. The hairs are very flat with a broad groove down one side. The fur is harsh, dusky grey at the base, then darker, tawny towards the extremities on the back, pale tawny on the abdomen; numerous longer hairs, either blackish throughout, or

* Reise nach Mossambique, Säugethiere, p. 157, Pl. XXXIII, Fig. 3, XXXV, Fig. 9.

† Prodromus Faunæ Zeylanicæ, p. 67.

‡ J. A. S. B., 1863, p. 351, and Catalogue Mam. Mus. As. Soc. p. 121, foot-note.

§ Mad. Jour. Lit. Sci. l. c.

with a pale tip, being scattered over the back, and producing the brown colour, which resembles that of a hare *(Lepus europæus* v. *L. ruficaudatus).* The average length of the hairs in the middle of the back is rather less than half an inch; the longer hairs measure 0·6 to 0·7 of an inch. The whiskers are black near the base, brown towards the ends, the longest being about the same length as the head. Muzzle thickly clad with short hair.

The ears are rounded, nearly naked, having only very short scattered hairs outside, but thinly clad with brown hair inside. The feet are pale brown above, the soles naked. The tubercles on the soles are well developed; on the fore-foot there are five, three arranged in a triangle at the base of the three middle toes, and two rather larger, close together, and nearly parallel, behind. The rudimentary hallux is behind the former tubercles and in front of the latter; it is furnished with a small flat nail; the other claws are compressed. In the hind-feet all five toes are furnished with compressed claws, much longer than those on the fore-toes. The second, third, and fourth hind-toes are nearly equal in length, the middle toe being scarcely longer than the others, and the fourth a little shorter than the second; the first and fifth toes also are subequal, the first being 7 mm. (0·27 inch) shorter than the second. The tubercles on the sole are in three pairs, each pair being nearly parallel, and the middle pair rather farther apart than the other two. The claws are pale horny in colour. The tail is stout at the base and tapers gradually to a fine point; it is rather shorter than the head and body, finely ringed, and thinly clad with short bristly hairs, which are black above, tawny on the sides and below. There are 2 pectoral and 2 inguinal pairs of mammæ.

The skull is typically murine, the deep fissure running downwards from the large infraorbital foramen being open as in ordinary rats; there is a well marked crest which runs along the edge of the frontal bones above the orbit, and is continued back over the parietal bones. The interparietal is convex behind and nearly straight in front; it is about half the breadth of the skull. The zygomatic arch is strong. The anterior palatine foramina *(foramina incisiva)* are very long and extend fully two-thirds the distance from the incisors to the molars, but their hinder termination is in front of the molar teeth. The incisors in both jaws are deep orange externally; those of the upper jaw are flat in front and have a rather deep longitudinal groove near the external edge; those of the lower jaw are flattened in front and smooth. The upper molars are broad with low crowns; the bony palate narrow. The surface of the upper molars consists of nearly semicircular lobes arranged in three longitudinal series, each lobe having its convex margin directed forwards. The anterior upper molar contains 7 lobes, three in the middle which are rather longer than the others, two inside which are rather less, and two outside which are the smallest of all. The two outer

lobes are parallel to the inner pair, but intermediate in position to those of the middle row. The second upper molar consists of 6 lobes, one of which, however, which is external and anterior, is very minute; of the other five two belong to the middle row, two to the inner, one to the outer, the posterior middle lobe having a spur on the outer side; the hinder upper molar has but 4 lobes, two belonging to the middle, and two to the inner row; the hindmost lobe belonging to the middle row is very small. The lower molars are nearly uniform in breadth, the first being a little narrower in front and consisting of seven lobes, 3 on each side, and a minute additional lobe in the middle behind; the second contains 5 lobes, two on each side, and a minute supplementary lobe in the middle behind; the last molar contains 4 lobes, two internal, one external, and a minute additional lobe in the middle at the back of the tooth; all these lobes in the lower molars, except the small supplementary talons and the hinder inner lobe of the last molar, are arranged in pairs, and the inner lobes are a little larger than the outer.

The following are dimensions in inches and parts of a metre, taken from the specimen preserved in spirit and from the skull extracted from it.

	inches.	metre.
Total length from nose to end of tail, ...	8·65	·219
Length from nose to anus, ...	4·55	·116
„ of tail, ...	4·1	·105
„ of ear from orifice, ...	0·57	·014
Breadth of ear,..	0·57	·014
Length of fore-foot (not including claws), ...	0·42	·011
„ of hind-foot (ditto), ...	0·9	·0225
„ of longest whisker,..........................	1·3	·032
„ of skull from occipital plane to end of nasal bones, ...	1·22	·0305
Greatest breadth of skull across hinder part of zygomatic arches, ...	0·62	·015
Length of suture between nasal bones, ...	0·42	·0105
Breadth of frontal bones between orbits, ...	0·19	·005
Length of anterior palatine foramina,..............	0·22	·0055
„ of row of upper molars,....................	0·26	·0065
Breadth of bony palate between anterior upper molars, ...	0·05	·0015
Length of lower jaw from angle to symphysial extremity (incisors excluded),.................	0·68	·017
Height of do. to coronoid process,.................	0·42	·0105
Length of row of lower molars, ...	0·23	·006

I have already mentioned that this rat is identical with specimens in the Indian Museum, Calcutta. The two skins which I have compared are

from the Asiatic Society's collection, and one of them is *Golunda Ellioti* No. 297 D. of Mr. Blyth's Catalogue from Southern India, presented by Mr. Elliot. The other, of which the label has been lost, is doubtless No. 297 E from Ceylon. These specimens, as already stated, agree very well with Kelaart's description of his *Golunda Ellioti (Mus coffæus)*,* but, as was remarked by Mr. Blyth, they do not agree with *Mus hirsutus*, Elliot,† although the specimens from Southern India appear to have been sent as representing that species, or at least *Golunda Ellioti*, with which *Mus hirsutus* was identified by Dr. Gray.

Mus hirsutus, the *Gulandi* of the Canarese, is described by Elliot as being $10\frac{1}{2}$ inches long, of which the head and body measure $6\frac{2}{3}$, and the tail $4\frac{3}{10}$, whilst the head is only $1\frac{1}{10}$ in. It is of course possible that these measurements were taken from a stretched skin, and that of the tail agrees fairly with the form above described, though its proportion to the body appears very different. But there are other distinctions: the ears are said to be villose, and although the fur is not described, a preliminary list of the species of rats and mice‡ in the South Mahratta country is given, in which the following are classed as having tuberculated molars and soft hairs—*Mus decumanus, rattus, mettade (lanuginosus), golundee (hirsutus), oleraceus, rufus*, and *musculus*—and opposed to *M. platythrix* and *M. Boodaga* said to have tuberculated molars and to be covered with hair and spines.

The original description of *Golunda Ellioti*, Gray,§ like too many of that author's descriptions, is quite insufficient for determination. Not a word is said of flat hairs: the fur is described as "pale brown, with minute very slender, hair pointed black tips." The ears are sa[illegible] abo[illegible] "covered with short hairs." No dimensions are given. The des[illegible] the[illegible] is included in a paper entitled "Description of some new or little-k[illegible] Mammalia, principally in the British Museum Collection." In th[illegible] of Mammalia in the British Museum, p. 113, the only specimen of *Golunda Ellioti* mentioned is stated to be from Madras and to have been presented by Walter Elliot, Esq. In this list *Mus hirsutus*, Elliot, is identified with *Golunda Ellioti*. It is to be noted that in the original description of *Golunda Ellioti* the habitat was said to be Bombay. Without consulting the British Museum specimens it is impossible to say whether the specimen presented by Mr. Elliot was the original type or not, but to judge from the name it probably was, so that there can be very little doubt of the

* Prod. Faun. Zeyl., l. c.

† Mad. Jour. Lit. and Sci. X, p. 213.

‡ *Ib.*, p. 208.

§ Charlesworth's Mag. Nat. Hist. I, p. 586.

identification of *Mus hirsutus* with *Golunda Ellioti;* and as the skin sent from Madras by Mr. Elliot as a specimen of the *Gulandi* is identical in species with the Ceylon coffee-rat, as well as with the specimen from Sind, there is no choice but to follow Mr. Blyth and consider all as belonging to one species, until the types can be compared.

Judging by the description alone, I should have thought the coffee-rat agreed much better with the description of *Mus platythrix*, Bennett, which is described as having flattened spines, naked ears, and the tail nearly as long as the body. The dimensions are smaller: head and body $3\frac{1}{4}$ inches, tail 3; but the proportions and colouration agree, and the type may not have been full grown. This form, however, is, by Elliot, identified with the *Leggyade*, an animal of very different habits from the *Gulandi*.

The question of synonymy must, therefore, be deferred. Meantime, the identification of an Indian rat with the African genus *Pelomys* is of some importance as adding another to the number of generic forms common to India and Africa, but not known to be represented to the eastward.

Pelomys fallax resembles *Golunda Ellioti* in colouration, general form, and dentition, but it differs widely from it in its other characters and in its habits. It is a much larger animal, the adult being about 300 millemetres [12 inches] long from nose to end of tail. It has a differently shaped head,* with the ears much smaller in proportion; the fur of *Pelomys fallax* is simply described as harsh and finely bristly *(hart und feinborstig)*, so that it probably presents none of the remarkable characters found in *Golunda Ellioti*. *P. fallax* is said to be found in marshy places, whilst *Golunda Ellioti* inhabits bushes on hill-sides.†

P. S.—Since the above was in print, I have received from Mr. Fairbank a specimen of the true *Gulandi*, brought to him at Ahmednagar by men of the Wadari or rock-diggar caste, the very people from whom Sir W. Elliot appears to have procured his specimens. These people hunt and eat rats and necessarily know all the species. The animal sent, an adult female, is specifically identical with the Sind rats and with those from Southern India and Ceylon, so there can no longer be a doubt as to the propriety of referring all to *Golunda Ellioti*. The face is not so convex as in the figure attached to this paper. The measurements are :—

* In the accompanying figure taken from the specimen in spirit after the skull had been extracted, the convexity of the face is much exaggerated. This is the form of the young animal only, I think. The head in the adult is very slightly convex.

† Whilst this paper was passing through the press, I also received from Mr. Fairbank specimens of the *mettad*, *Golunda meltada*, Gray, obtained at Ahmednagar. They differ so much from *G. Ellioti* that I doubt if the two forms are congeneric. In *G. meltada* (potius *mettada*) the incisors are not sulcated, the molars differ but little from those of *Mus*, and the palate is much broader than in *G. Ellioti*.

	in.
Length from nose to insertion of tail, ...	4·75
„ of tail, ...	4·
„ of hind foot, ...	0·92
„ of ear from orifice, ...	0·6

A specimen of a rat obtained by Mr. V. Ball in the Sátpura Hills and presented by him to the Indian Museum, also belongs to this species.

EXPLANATION OF PLATE X.

Fig. 1. Head of *Golunda Ellioti*, Gray, from Sind (the face is represented much too convex). 2. Right hind-foot. 3. Right fore-foot (the intermediate tubercle should have been drawn further away from the posterior (proximal) pair). 4. Under view of the skull. 5. The skull and mandible, seen from the side. 6. Upper view of the skull. 7. Incisors, seen from the front. 8. Molars of upper jaw, right side. 9. Do. of lower jaw, right side.

XII.—*On the* Cyclostomacea *of the Dafla Hills, Assam.—By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., Deputy Superintendent Topographical Survey of India.*

(Received June 24th;—Read August 2nd, 1876.)

(With Plates VII & VIII, A, Figs. 1—6.)

The expedition into the Dafla Hills in the winter of 1874—75 has added very largely to our knowledge of the land-shells of that part of India. The line of the Himálayas has been very well worked up to the neighbourhood of Darjiling, and the researches of the Messrs. Blanford and the late Dr. Stoliczka have left I suspect very few forms undiscovered in that quarter, but from thence to the Dafla Hills, a distance of 270 miles, we had received nothing, so that when I found myself deputed for survey duty in these more eastern hills, I anticipated a goodly haul of molluscan forms, and am glad to say I have not been disappointed. The present list is confined to the operculated group, numbering some 33 species; of which 11 are new; 5 had been originally described from Darjiling and have their range thus extended far to the eastward; 13 are well-known forms in the Khasi and Naga hill-ranges south of the Brahmaputra River; and 3 or 4 are known to extend thence to the Shan States in the Irrawaddy drainage-system. The list of *Helicidæ* will be given in a second paper, in the prepa-

ration of which I hope to be joined by Mr. G. Nevill of the Indian Museum, Calcutta; and will comprise some 45 species, many of which are new. I had ample opportunities for collecting, especially while forest-clad peaks were being cleared for the triangulation. The weather, which during the whole of January was so very wet as to render the taking of observations for days together an impossibility, was just the kind that was wanted to tempt the smaller forms forth from their hiding places in the decaying leaves and old tree-stumps. In some of the Khasi and Goorkha men of the Survey party I found most energetic and excellent collectors, who soon were as sharp with their eyes in detecting the minute little shells as I myself was. It caused them at first infinite amusement and still greater curiosity as to what possible use they could be put to: "Calcutta jádú ghur ke waste," however, generally satisfied all queries on the subject, and a general impression prevailed that we made medicine of them.

Abstract of Genera.

	Darjeeling.	Khasi.	Dafla.	Total.	Remarks.
1. *Cyclophorus*, ...	1	3	3	7	
2. *Lagocheilus*, ...	..	1	..	1	
3. *Pterocyclos*, ...	..	1	..	1	
4. *Spiraculum*, ...	..	1	1	2	
5. *Alycæus*, ...	..	3	6	9	3 being varieties of Khasi species.
6. *Diplommatina*, ...	1	2	3	6	1 being a variety of a Khasi species.
7. *Pupina*, ...	..	1	..	1	
8. *Streptaulus*, ...	1	..	..	1	
9. *Megalomastoma*, ...	1	..	1	2	
10. *Pomatias*, ...	1	1	1	3	
Total,....	5	13	15	33	

No specimens of either of the genera, *Cyathopoma*, *Georissa*, or *Hydrocæna*, which come in on the hill-ranges south of the Brahmaputra, were found: they are apparently absent.

CYCLOPHORUS AURORA, Bs.
Agrees with the specimens from Dalingkote, Western Bhutan Dúars.

CYCLOPHORUS PEARSONI, Bs.
Outer Range.

CYCLOPHORUS FUSCICOLOR, n. sp., Pl. VIII, A, Fig. 1.

Shell umbilicated, globosely turbinate, covered with a greyish umber-brown epidermis, with radiating longitudinal lines of ornamentation, the bands of colour rather broader towards the apex, but throughout very close together, in some specimens coalescing on the last whorl into a uniform dark shade of brown. Spire conical, apex sharp. Whorls 6, well rounded, with a single slightly raised ridge upon the keel. Aperture circular, sub-oblique, peristome continuous, double, very slightly reflected. Within the aperture grey.

Alt. 1·24, major diam. 2·30 inches.

HAB.—Dafla Hills.

This is a very distinct form allied to *C. Bensoni* from the southern face of the Khasi Hills, shewing towards the apex in some specimens a tendency to the zigzag painting of that shell, but the uniform, striate, and sober colouring of the rest of the whorls is a very marked character. Two specimens have a moderately broad white band on the periphery, owing to the abrasion of the epidermis upon the raised ridge of the keel.

CYCLOPHORUS EXPANSUS, Pfr.
HAB.—Outer sandstone range.

CYCLOPHORUS ZEBRINUS, Bs.
HAB.—Outer range,—very abundant.

CYCLOPHORUS (MYXOSTOMA) NIVICOLA, n. sp., Pl. VII, Figs. 1 & 1*a*.

Shell flatly discoidal, openly umbilicated. Whorls 5, with distinct longitudinal striation, the last well rounded on the periphery, large, the rest rapidly decreasing, covered with a thick epidermis, colour dark brown-umber. At half the circumference from the apex fine zigzag pale ochreous markings ornament the upper surface; these widen and are arranged closer towards the apex, which is pale; a black band on the periphery is bounded by a pale narrow one. Spire slightly raised. Suture deep. Aperture oblique, very slightly descending, circular. Peristome thickened, double, reflected, with a small re-entering notch near the suture. Operculum corneous, flat.

Major diam. 1·0, alt. 0·45 in.

HAB.—Dafla Hills.

This form is a representative here of the Ceylonese *C. Bairdii.* A variety of the same size but plain, with pale band on the periphery, on Torúpútú Peak. Small (major diam. 0·65 in.) varieties also occur, both ornamented and plain; the latter are very similar in size and light ochreous colouration to *C. ravidus* of the Nilgiri Hills, but the former have fine zigzag markings and a single black band on the periphery.

LAGOCHEILUS TOMOTREMA, Bs.

HAB.—The Tánir ridge and Torúpútú Peak,—not common.

PTEROCYCLOS PARVUS, Pearson.

HAB.—Shengorh, Tánir ridge, and Torúpútú.

PTEROCYCLOS MAGNUS, n. sp., Pl. VII, Figs. 3, 3*a*, & 3*b*.

This shell is similar in form to *P. parvus,* only that the winged portion of the peristome is far more fully developed and folded round into a perfect, largely developed tube with its internal orifice just within the aperture, the inner lip being deeply notched to give room for it. The shell is ornamented with a single black peripheral band and with minute transverse brown zigzag markings. Apex very flat. Whorls 5, rounded.

The largest example measures—alt. 0·26, major diam. 0·95, minor diam. 0·75, apertural tube 0·20 in.

HAB.—Very common in the outer sandstone range, Dafla Hills. It is also found on the northern side of the Nágá Hills, but has hitherto never been separated from *P. parvus* of the Khasi Hills, of which it may be said to be a more developed form, with stronger affinities to the genus *Spiraculum.*

SPIRACULUM HISPIDUM, Pearson, var. MINOR.

HAB.—The outer ranges near Dihiri Parbat. Agrees precisely with specimens from Teria Ghat. It is curious, however, to note that the large variety does not occur here, but that its place is occupied by another new form equally large, which I next describe.

SPIRACULUM NEVILLI, n. sp., Pl. VII, Figs. 2 & 2*a*.

Shell discoidal, convexly depressed, widely umbilicated, covered with a dark brown epidermis which soon becomes eroded, and with an incipient dark band on the keel in perfect specimens. Spire very slightly raised, suture deep, whorls 5, much rounded, the last descending slightly towards the aperture. The sutural tube is only 0·10″ in length, 0·3″ behind the aperture, turns back, and is situated close to the suture. Aperture oblique, circular. Peristome double, inner lip continuous, having at the suture a re-enter-

ing angular notch, the outer is similarly notched and then expanded and folded into a spout-shaped form. Operculum not seen, probably as in *S. hispidum.*

Alt. 0·36, major diam. 1·05, minor diam. 0·92, diam. apert. 0·45 in.

Hab.—Two specimens only were obtained near Dihiri Parbat, on the outer sandstone range.

This *Spiraculum* is quite distinct from *S. hispidum*, for which I mistook it when found, and consequently omitted to search for more examples. In the form of the sutural tube it most nearly resembles *S. Avanum*, W. Blf., thus differing very considerably from *S. hispidum*, in which that part is broad and curves quite over and across the suture in well-grown shells (pl. vii, fig. 4). The most notable point of difference, however, is the expansion of the outer lip into a tube-like process, in which respect the species shews its very close affinity to the genus *Pterocyclos.*

Alycæus Khasiacus, G-A.

Hab.—One specimen of the true typical form was found in the Yétay ravine, Dikrang Dhún.

Alycæus Khasiacus, var.

The rest of this type from other parts of the hills, however, differ from the Khasi form, in the ridge in front of the constriction being single, and the peristome more thickened and reflected. But in size, sculpture, and the short thickened sutural tube, as well as in the operculum, no change is to be detected.

Hab.—Valley of the Dikrang and Borpani.

Alycæus crispatus, G-A.

Hab.—A conical form of this shell was obtained in the Burroi gorge.

Alycæus Theobaldi, Bs., var., Pl. VII, Fig. 10.

Is of the same form as *A. Theobaldi* from Cherra Poonjee and the Gáro Hills, only that while the operculum in the latter is exceedingly closely wound, quite smooth in front, and black (and I have examined some dozens of shells), in the former the concentric whorls are wider apart, have a central circular hollow space, and are white. The ribbing of the swollen portion in the Dafla shell is exceedingly minute, and this, I note, is a common character, holding good almost without exception, of all the species in the Dafla Hills. There is, moreover, a slight difference in the contraction of the whorl near the umbilicus, but I hesitate to separate two such close forms, notwithstanding that if dozens of each variety were thrown together, they might all be resorted without a mistake, and I have

a large series. It has yet to be decided what points are to be considered of sufficient weight in separating these forms from one another. We must wait until the whole area has been worked, and the points of difference, however small, all noted, when we shall then be in a position to reduce species or to arrange slightly divergent forms around their nearest and most abundant and widely spread ally. As far as my experience goes, they never remain constant over very large areas.

Hab.—The above shell was obtained on the slopes of Torúpútú.

Alycæus Burtii, G-A.

Hab.—This shell, of which I previously possessed a single specimen only, found by Mr. J. Burt in the gorge of the Barowli river a short distance to the west, proved to be abundant on the outer sandstone range about Dihiri Parbat, the Burroi gorge, &c.

A variety of it, which is much larger and more depressed in form, but which in the crenate peristome and in form of constriction is the same, occurred in the valley of the Dikrang and in the Yetay ravine. This variety measures in alt. 0·18, major diam. 0·25. in.

Alycæus notatus, n. sp., Pl. VII, Figs. 9, 9*a*, & 9*b*.

Shell globosely turbinate, narrowly umbilicated, of solid form, white, distant strong costulation on the upper whorls, close and fine ribbing on swollen portion of the last. Spire conoid, suture fairly impressed. Whorls 4½, closely wound, the last swollen, then sharply constricted, and again enlarged and descending, the expanded portion being marked with deep fold-like furrows. Sutural tube moderate, aperture oblique. Peristome very thick, distinctly treble in full-grown shells, outer layer terminating just behind the aperture, the inner continuous, the two outer much reflected near the umbilicus. Operculum smooth in front.

Alt. 0·14, major diam. 0·17. in.

Hab.—On the slopes of Torúpútú Peak at 3000 feet, about 15 specimens collected.

This is one of the most distinct and curious species I have yet discovered, the fold-like indentations upon the expanded portion near the aperture having no counterpart in any other form with which I am acquainted. In other respects it is somewhat similar to *A. diagonius*, in the strong thick peristome and closely wound whorls.

Alycæus Daflaensis, n. sp., Pl. VII, Figs. 12, 12*a*, & 12*b*.

Shell turbinate, moderately umbilicated, pale whitish or dull ochreous according to the state of the epidermis, finely ribbed throughout, rather more coarsely near the commencement of the swell of the last whorl, on this por-

tion the ribbing is very fine and close. Spire conoid, apex blunt, suture impressed, the sutural tube moderate. Whorls 4, the last swollen, then constricted, and enlarging again into a well-raised ridge, which terminates below on margin of the peristome, it then descends and expands considerably with four deep longitudinal plications. Peristome single (no sign of the usual outer margin), continuous, with five plications on the outer margin, the lower margin recurved. Aperture oblique. Operculum multispiral, horny, with a large disc-like boss in the centre front side.

Hab.—Torúpútú Peak, 7000 feet.

The nearest form to the above is *A. digitatus*, H. Blf., described and figured in J. A. S. B., Vol. XL, 1871, from Darjeeling, but the duplicate peristome in that shell is conspicuous and forms a well-defined sharp edge where the expansion and plication of the inner lip commences. By the operculum alone it can be at once distinguished, and it is besides a much smaller shell.

A dwarf variety occurs on Shengorh peak only 0·09 in alt., not so expanded near the aperture, and with the plication less developed. On the Tánir ridge at 4000 feet, the same shell, of ordinary size and with the same character of the aperture, occurs, shewing an interesting and gradual change in form; the operculum is also different, being pale coloured, multispiral, and flatly concave in front. This form is in this respect much nearer to *A. digitatus* and might be separated under the title *sub-digitatus*.

Alycæus mutatus, n. sp., Pl. VII, Figs. 11 & 11*a*.

Shell sub-turbinately depressed, openly umbilicated, fragile, covered with a scabrous dull ochreous epidermis, which peels off in old shells, very regularly and strongly striated throughout, the ribbing on the last whorl very fine. Spire sub-conoid, apex rather blunt, suture deeply impressed. Whorls 4, rounded, the last swollen, moderately constricted, then again expanded and crossed by two ridges, the last of these not extending all round the whorl. The constriction very regularly ribbed. Sutural tube short, thickened at the base. Aperture oblique, circular. Peristome double but closely united, very slightly reflected. Operculum multispiral, the edges of the outer whorls in high relief so as to form a deep cup-like hollow in the centre.

Alt. 0·10, major diam. 0·20, sutural tube 0·055 in.

Hab.—On Torúpútú, Tánir, and Shengorh Peaks, at 6—7000 feet elevation, in the dead leaves and moss about the roots of the forest trees, I found about a dozen. The ground at the time was covered with snow, so that it was very cold work hunting for them.

This shell is an interesting ally of *A. Khasiacus*, from which it differs in its thick well-ribbed epidermis, but more especially in the very different

form of the operculum, which in *Khasiacus* is quite smooth and concave in front. It is also a smaller and more delicately formed shell.

ALYCÆUS (DIORYX) GRAPHICUS, Blf., var.

HAB.—Both in the Dikrang Dhún and on Torúpútú Peak.

ALYCÆUS (DIORYX) URNULA, Bs., var.

Higher in the spire, aperture proportionally larger; whorls more rounded, sutural tube only one-fourth the length, and the ribbing much less fine on the swell of the whorl—differences which by some would be considered quite sufficient to warrant another name being given to this Dafla form. Five specimens were found all possessing the above character, so it would appear to be quite constant.

DIPLOMMATINA POLYPLEURIS, Bs., var.

HAB.—Borpáni, Sújúli, and Dihiri Parbat on outermost range.

DIPLOMMATINA POLYPLEURIS, var. MINUTA.

HAB.—Shengorh and Torúpútú Peaks.

DIPLOMMATINA SEMISCULPTA, W. Blf.

HAB.—Borpani and Dikrank valley,—a good many specimens obtained.

DIPLOMMATINA AUSTENI, W. Blf., large var., Pl. VII, Figs. 8 & 8*a*.

Shell dextral, ovate fusiform, moderately thick, pale horny. Sculpture very fine, almost disappearing on the two last whorls. Sides of spire moderately flat. Whorls 7, penultimate and antepenultimate the largest, the last ascending slightly. Constriction in middle of aperture, which is circular and vertical; columellar margin rounded, tooth moderate. Peristome simple, double, rather strongly formed, the inner lip continuous.

Alt. 0·15, diam. 0·70 in.

HAB.—Low down on the left bank of the Dikrang river;—about a dozen were found.

This shell is very similar in form to *D. Austeni*, W. Blf. from the Khasi Hills, but it is much larger, that shell only being 0·90″ in length, and the two last whorls are not so smooth and shew slight traces of sculpture, but the two are too close to be separated.

DIPLOMMATINA HOMEII, n. sp., Pl. VII, Fig. 6.

Shell dextral, ovate, tumidly fusiform, strong, dull ochreous, very fresh shells often ruddy orange-coloured, sculpture very fine and filiform on the upper whorls, rather coarser on the last approaching the aperture. Spire

with sides rather flat, penultimate and antepenultimate whorls about equal, the last whorl has the constriction in the middle of the aperture, and ascends to it. Aperture vertical, columellar margin angular below, the tooth well developed and placed low down; outer margin rounded. Peristome thick, double, both lips continuous and well reflected on outer margin.

Alt. 0·24, diam. 0·14, diam. apert. 0·08 in.

HAB.—In forest on the peaks of Torúpútú and Shengorh, very abundant.

This species is conspicuous from its large size and tumid flat-sided form. I have named it after Lieut. H. Home, R. E., who, with his company of Sappers, rendered so much assistance in clearing the peak on which I first found this shell; and it is with feelings of extreme regret that I have to record the death by sun-stroke a few months after of this able, zealous, fine young officer.

DIPLOMMATINA LEVIGATUS, n. sp., Pl. VII, Fig. 7.

Shell dextral, tumidly fusiform, colour pale horny, very smooth throughout, slight close colouration on the four apical whorls. Spire rather rapidly diminishing towards the apex, this is rather sharp in some specimens. Suture moderately impressed. Whorls 7, antepenultimate the largest and swollen, the penultimate constricted in front of the aperture, the last ascends but slightly and is puckered on the posterior margin, corresponding with the angular projections of the outer lip. Aperture vertical; peristome solid, double, the inner lip continuous, circular, the columellar process or tooth moderate, the outer lip with an undulating margin, square below, with angular projections, two below and one on the upper outer margin.

Alt. 0·15 in.

HAB.—The Dikrang valley, Dafla Hills.

This is a very distinct form from any I am acquainted with: the waved margin and angular expansions on the outer lip are its most peculiar characters, and mark at once its distinctness.

PUPINA IMBRICIFERA, Bs., var.

HAB.—Dafla Hills. The small variety like that of the Nágá Hills. Only two obtained, the shell appearing to be rare on this side.

STREPTAULUS BLANFORDI, Bs., Pl. VIII, A, Figs. 2, 3, & 4.

HAB.—Harmutti, the Tanir ridge, and Dikrang valley; one only from 7000 feet,—an abundant shell in the low ground.

The true typical form ranges from 1000 to 4000 feet as a rule. There are, however, two other forms, one of which has been alluded to by Mr. W. T. Blanford in his paper on the 'Classification of the Cyclostomacea of

Eastern Asia' (Ann. and Mag. Nat. Hist., June 1864), and considered by him to be perhaps worthy of specific distinction; in this (which I distinguish as var. *α*) the internal tube opens in the peristome outwards, with no tendency to form an external sutural tube: of it I obtained three fine specimens on Shengorh Peak, where it was associated with the other forms. In the other (var. *β*, or var. *tubulus*), which was only obtained in one locality at 5000 feet on the flanks of Torúpútú, there is a still wider departure from *S. Blanfordi*, Bs.; the internal tube passes out just behind the peristome, almost in the same way as in *Rhaphaulus chrysallis*, Bs., and is directed upwards for about 0·05″ of an inch. These differences are very remarkable, occurring as they do in distinct species from Malayana, and I should be inclined to consider them worthy of specific titles were the habitats of the two forms wider apart, but both occur together, and in no other point of structure can I detect any constant difference. I at first thought that var *β*. was more tumid and depressed and that it had a more developed aperture, but similar continuous, thickened, circular peristomes are to be found among the normal forms, when a large series is examined; and the same holds good of the external shape. I am sorry that I had no opportunity of examining the animals of these three forms: some considerable modification of parts must surely be required to produce the very great differences in the length and direction of this tube-like process near the aperture.

Particularly fine examples of *S. Blanfordi* were found, as much as 0·43 in length and 0·28 in. in diameter.

Megalomastoma pauperculum, Bs.

Hab.—Shengorh Peak and Torúpútú. This form was found at all the higher elevations, whereas I did not obtain a single example that will assimilate with *M. funiculatum* from Darjeeling, either in form or colouration.

Megalomastoma tanycheilus, n. sp., Pl. VII, Fig. 5.

Shell cylindrical, turreted, solid, pale ochreous, sometimes with a tinge of green, rather strongly and diagonally striated. Spire straight, sides nearly parallel, apex conoidal, suture shallow. Whorls 9, with very slight convexity of side. Aperture vertical, large, and circular, the peristome continuous, very largely developed, thickened, and expanded; at base of the last whorl is a strong keel which terminates above near the centre of aperture. Operculum composed of several horny layers, which appear to be formed slowly and concentrically on a line radiating from the centre to the circumference.

Length. 1·20, diam. 0·35, diam. apert. (peristome included) 0·32 in.

Hab.—Dikrang valley, low down, ranging up to about 2,500 feet and very abundant.

This shell is a much wider departure from the Darjeeling form first described by Benson, *M. funiculatum*, which is so much more tumid, shorter in spire, of a dark purplish brown colour, and never has the peristome so broad and thickened as in this species. *M. pauperculum* is intermediate between the two.

POMATIAS HIMALAYANÆ, Bs.

HAB.—Torúpútú and Shengorh Peaks.

POMATIAS PLEUROPHORUS, Bs.

HAB.—Very fine specimens were obtained at the village of Pachitah (Camp 7); it was also got at Harmatti. Alt. 0·32, diam. 0·17 in.

POMATIAS GRANDIS, n. sp., Pl. VII, Fig. 13.

Shell dextral, perforate, turreted, rather swollen below, solid, with moderately strong close costulation throughout, smooth on the penultimate whorl above the aperture, very close fine ribbing behind the aperture; covered with a thin epidermis; grey corneous or pale ochreous. Spire rapidly decreasing to apex. Whorls 9, slightly convex, the last rounded below. Aperture vertical, circular. Peristome double, thickened, reflected, continuous, slightly angular at upper outer margin. Operculum thin, horny, indistinctly spiral in some specimens.

Alt. 0·55, diam. 0·20, diam. ap. 0·17 in.

HAB.—Shengorh Peak, rather abundant in moss on rocks.

Its very large size distinguishes it at once from *P. himalayanæ* and *P. pleurophorus*, but it also differs in its more tumid form, the greater number of its whorls, its rounder aperture without the distinct small notch, and in not being so strongly costulated.

The three following species were found as far back as 1866-67, while the survey of the Khasi and Garo hill-ranges was in progress. I was in hopes that Mr. W. T. Blanford, who has described so many species of the same genus, would have been able to publish these also, but his hands have been so full since then with the large and very important collections from Abyssinia and Persia made by himself, and more recently with those from Yarkand, together with the ordinary work of the Geological Survey, that they have been laid aside. Of two of them years ago I prepared figures, which are now introduced to complete Plate VIII, A. All three are referred to *Cyathopoma*—a genus which has not before been recorded from this part of India. In form these eastern species assimilate with

some from Southern India; but it is interesting and important to note that as regards the operculum there is a distinct departure, the former having this appendage very similar to some *Alycæi* of the same province. I, however, consider them nearer to *Cyathopoma* than to any other genus, and it is not desirable to separate them until something more is known of the animals.

1. Cyathopoma Jawaiensis, n. sp., Plate VIII, A, Fig. 6.

Shell narrowly umbilicated, turbinate, covered with a dark umber epidermis. Whorls 4½, well rounded, with four well raised longitudinal ribs on the last, three shewing on the whorls above. Spire conical, apex papillate. Peristome simple, lip thin; aperture circular, the lirate ribbing extending up to the peristome so as to give it on the exterior margin an angular outline. Operculum pure white, situated close to the margin of the aperture, deeply concave in front, many whorled, with a small dark spot in the centre.

Alt. 0·07, major diam. 0·06 in.

The animal has long pointed pale tentacles, with the eyes on the upper outer basal margin (fig. 6 *c* having been drawn from a dead specimen, the tentacles are represented in a contracted condition). The labial ribbon (fig. 6 *b*) is very similar to that of *Diplommatina*, all the teeth being five-cuspid in the usual arrangement 3—1—3, with the central rather broad.

Hab.—This little shell is very abundant in the woods close to Jawai among dead leaves, and I found the first specimen close under the Dak bungalow at that place. The very white operculum with the dark central spot contrasting with the dark colour of the shell is a very conspicuous character.

In the Nágá Hills I afterwards obtained a slightly larger form to which the above description would apply, only that the operculum is not so deeply concave and is situated well within the aperture, whereas in several dozen specimens of *Jawaiensis* examined the position of the operculum is external.

2. Cyathopoma Nevilli, n. sp., Plate VIII, A, Fig. 5.

Shell elongately turbinate, very closely umbilicated, covered with an olivaceous epidermis. Whorls 5½, rounded, with four well marked spiral ribs and one basal near the umbilicus. Apex blunt. Aperture rounded, peristome simple, continuous, very slightly thickened and reflected, operculum well within the aperture, slightly concave, minutely multispiral, with a large central plain area.

A very large specimen measures alt. 1·1, major diam. 0·08, but some are only 0·07 in. in alt. Animal not observed.

Hab.—Khási and Nágá Hills, in damp situations among decaying vegetation at about 4000—5000 feet, not by any means abundant. I at first considered it to be a *Jerdonia*, from its remarkable similarity in external form to *J. trochlea*, Bs., from Southern India, but on comparison of the opercula I found a considerable difference. It is a smaller shell than *J. trochlea.*

3. Cyathopoma Garoense, n. sp.

Shell openly umbilicated, turbinate, white, multilirate. Whorls 5, well rounded; there are six well marked longitudinal ribs on the last whorl, the interval between the 4th, 5th, and 6th being wider than that between the ribs above. Succeeding these below near the umbilicus can be counted eight very close lines of ribbing; the whole surface between this ribbing is sharply and regularly striate, giving it rather a lace-like appearance. Spire conoid, apex high and papillate. Peristome simple, quite circular, single. Operculum exposed in front close to the margin of the aperture, multispiral, flat in front, thick and shelly in appearance. Animal not observed.

Alt. 0·08, major diam. 0·09 in.

Hab.—It was first taken on limestone rocks in the South Garo Hills, and was particularly abundant at Rywuk on the Sumessary river in the limestone cliff on the left bank of the river; it must extend all along the southern face of the hills with the run of the Nummulitic rocks, for I have two specimens in my collection from the South Jaintia Hills. *C. Garoense* is very like the South Indian *C. Deccanense,* W. Blf., in the sculpture and position of the operculum.

No species of *Cyathopoma* have as yet been obtained anywhere to the north of this line of hills, not one occurred among the large collection of shells made in the Dafla Hills, the most eastern part of the Himalayan range that has as yet been explored.

EXPLANATION OF THE PLATES.

Plate VII.

Fig. 1. *Cyclophorus nivicola*, n. sp., nat. size.
„ 2. *Spiraculum Nevilli*, n. sp., nat. size.
„ 3. *Pterocyclos magnus*, n. sp., nat. size.
„ 4. *Spiraculum hispidum*, Bs., sutural tube, nat. size.
„ 5. *Megalomastoma tanycheilus*, n. sp., nat. size.
„ 6. *Diplommatina Homeii*, n. sp., enlarged.
„ 7. ——— *levigatus*, n. sp., enlarged.
„ 8. ——— *Austeni*, Blf., large var., enlarged.
„ 9. *Alycæus notatus*, n. sp., enlarged.
„ 10. ——— *Theobaldi*, Bs., var., the operculum, enlarged.
„ 11. ——— *mutatus*, n. sp., enlarged.
„ 12. ——— *Daflaensis*, n. sp., enlarged.
„ 13. *Pomatias grandis*, n. sp., slightly enlarged.

Plate VIII, A.

Fig. 1. *Cyclophorus fuscicolor*, n. sp.
„ 2. *Streptaulus Blanfordi*, Bs. (the shorter line shews the height of the aperture, the longer, the length of shell).
„ 3. ——————— var. *α*.
„ 4. ——————— var. *β*. (*tubulus*.)
„ 5. *Cyathopoma Nevilli*, n. sp.
„ 6, 6*a*. ——— *Jawaiensis*, n. sp.
„ 6*b*. ——————— labial ribbon.
„ 6*c*. ——————— head of animal shewing position of the eyes (the sketch was taken from a specimen after removal from its shell, the tentacles are therefore much contracted).
„ 7. *Carychium Indicum*, Bs.
„ 8. ——— *Khasianum*, G-A.

XIII.—*Descriptions of some new Land and Freshwater Shells from India and Burmah.—By* W. Theobald.

(Recd. June 4th ;—Read July 7th, 1875.)

(With Plate XIV.)

Sesara Hungerfordiana, n. sp., Pl. XIV, Fig. 1.

Testa lenticulari, imperforata, cornea, confertim transverse striata, ad apicem obtusum et umbilicum circa lævigata. Anfractibus sex lente crescentibus, ultimo acute sive filiforme carinato, et ad aperturam (per anfractus ultimi dimidium) descendente. Apertura fere verticali, marginibus callo tenuissimo junctis. Labio incrassato, dentibus tribus æquidistantibus instructo, dente interiori libero, cæteris callo brevi junctis.

Lat. major 11·00, *lat. minor* (?) 11·00, *alt.* 5·50 *mm.*

Habitat ad 'Mizan-toung' prope ripas 'Salwin' fluminis provinciâ 'Martaban' haud procul a Maulmein.

This interesting addition to the *Sesara* group was forwarded to me by Dr. Hungerford from near Maulmein. It recalls *T. Attaranensis*, Th., but differs in its descending last whorl, and in its teeth, which are larger and more equal, whilst the callus uniting the two outer ones is less developed than in that species, in which it constitutes a horse-shoe-shaped fillet. In some specimens the shell may be perforate, as it is a thin callus only which seems spread across the narrow umbilical opening.

Sesara inermis, n. sp., Pl. XIV, Fig. 2.

Testa sublenticulari, angustissime umbilicata, depressa, cornea, subpolita, sed supra exilissime transverse striata. Anfractibus septem, ultimo

filiforme carinato, non descendente. Apertura fere verticali. Labio subincrassato, sinuato, dentibus nullis instructo.

Lat. maj. 11·60, *lat. minor.* 10·80, *alt.* 4·80 *mm.*

Habitat in valle fluminis 'Salwin' haud procul a Maulmein provinciâ Martaban.

The exact locality where I procured this species I do not know, beyond that it was near the Salween. It is interesting as the simplest form of the group to which it belongs, having no teeth and rather feeble striation. Its habit, however, is quite that of a *Sesara*, and it comes from what is almost the headquarters of the group in Burmah.

CORASIA BOURDILLONII, n. sp., Pl. XIV, Fig. 3.

Testa conoidea, obtecto-perforata, carinata, tenui, polita, albida, translucente, sub epidermide pallide straminea et decidua lineis exilissimis flexuosis spiraliter ornata. Anfractibus $4\frac{1}{2}$, *celeriter crescentibus, ad apicem mammillatum paullo convexis, sed ultimo supra planato et circa umbilicum paullo inflato. Apertura magna subquadrata; marginibus simplicibus callo tenuissimo junctis.*

Diam. maj. 25·4, *diam. min.* 19·5, *alt.* 14·8, *aperturæ alt.* 16·0, *ejusdem lat.* 14·0 *mm.*

Habitat montibus in umbrosis provinciâ Travankor haud procul a Trevandrum Indiâ Australi, teste F. Bourdillon.

A few dead examples of this handsome and evidently arboreal species have reached me through the kindness of Mr. Bourdillon, after whom I have named it, and to whom I am indebted for a small collection of shells from the same locality. Among these were *Cyclophorus Niligiricus*, *Cataulus Calcadensis*, *Myxostoma deplanatum*, *Micraulax scabra* n. sp., *Ditropis planorbis*, *Mychopoma hirsutum*, the recently described *Hemiplecta Beddomei*, *Rotula indica* (a large form of 28 mills and a small stout form of 17 mills), *R. Shiplayi*, *Sitala apicata*, a single reversed arboreal *Helix* of the *albizonata* type (*Geotrochus Calcadensis*), a *Glessula* which seems a mere variety of *G. parabilis*, a stouter form with more arcuate columella (probably *G. Deshayesiana*), and a small species not determined, a *Streptaxis*, and *Hapalus Travankoricus*, n. sp.

MICRAULAX, subgenus novum.

Cyclophori *habitu planorbulari, testa sulco brevi intus instructa, operculo ?*

MICRAULAX SCABRA, n. sp., Pl. XIV, Fig. 4.

Testa late et profunde umbilicata, et sulco haud profundo et valde inconspicuo intus instructa, linea parum elevata externe notato. Anfractibus

4—4½ *convexis, ultimo subinflato, celeriter crescente, et ad aperturam non descendente. Epidermide scabra, juxta aperturam corrugata. Apertura parum obliqua, subcirculari, breviter adnata. Operculo?*

Lat. major 14·20, *lat. minor* 12·00, *alt* 6·20, *aperturæ lat.* 6·00 *mm.*

Habitat montibus in umbrosis provinciæ Travankor Indiâ Australi, teste F. Bourdillon.

This is a very interesting section of the planorbular *Cyclophori*, uniting the *Myxostoma* type with the turbinate *Lagocheilus*. The canal of *Cataulus* is merely, it would seem, a more highly developed and specialised representation of the shallow groove in this species.

Hapalus Travankoricus, Th., Pl. XIV, Fig. 5.

Testa turrita, anguste umbilicata, tenui, translucenti-cornea; epidermide sericea. Anfractibus 5 *valde convexis. Apertura verticali, quadrato-ovata, marginibus simplicibus, aliquando callo tenui junctis; labio ad umbilicum paullo reflexo.*

Alt. 6·5, *lat.* 3·9, *aperturæ alt.* 2·2, *ejusdem lat.* 1·5 *mm.*

Habitat montibus in umbrosis provinciæ Travankor Indiâ Australi, teste F. Bourdillon.

It has been suggested that this is nothing more than the young of *Cataulus Calcadensis*, numerous specimens of which were forwarded to me at the same time, but it differs from the young of that species when of the same size, as was seen from numerous examples. Two specimens only of the present form were found, both dead shells, but in fair condition. The form of the mouth is peculiar and the silky lustre of the epidermis also.

Spiraculum Bhamoense, n. sp.

Testa depressa, aperto-umbilicata. Apice elevatiusculo, sutura profunda, anfract. 4½ *convexis, ultimo juxta aperturam parum descendente. Epidermide tenui, leviter striata, vix scabriuscula. Colore corneo-albescente, fasciâ mediana cincto, strigisque castaneis fulguratis picto, superioribus latis, inferioribus autem (sive subfascialibus) angustis. Aliquando unicolore, corneo-stramineo. Apertura obliqua magna. Peristomate duplici, intus ad suturam angulato-inciso; extra alam linguiformem subtubularem horizontalen adnatam formante. Tubulo suturali recurvato ab apertura* 3 *mm. distante.*

Diam. max. 11·00, *diam. min.* 8·50, *alt.* 5·50 *(-oris diam.) apertura* 5·20 *mm.*

Habitat prope Bhamo valle Iravadi Regno Burmanico.

The nearest ally of this interesting form is *S. Avanun*, W. Bl., which it approaches in the recurved form of its sutural tube, but it differs in size and mode of colouration. In *S. Avanum,* too, the linguiform projection of

the peristome is vertical, not as in the present species horizontal. The colouration, too, is peculiar, the fulgurate stripes above the peripheral band being much more open or more obtusely bent than in the narrow or more acutely angled bands below it.

SPIRACULUM BITUBIFERUM, n. sp.

Testa depressa, late umbilicata, apice depresso, sutura profunda, anfract. 5 *convexis, ultimo prope tubulum paullo ascendente, inde descendente. Epidermide scabriuscula spiraliter striata; colore albido, transverse vix subfulgurate castaneo strigato. Perist. simplici, expansiusculo, recurvato, prope suturam alam formante, tubulo brevissimo sursum spectante instructo. Tubulo suturali recurvato ab apertura* 8 *mm. distante. Apertura obliqua.*

Diam. max. (peristomate incluso) 18·30, *diam. min.* 14·00, *alt.* 7·00, *apert.* 7·80 *mm.*

Habitat prope Bhamo cum precedente.

This remarkable species differs from most others in possessing a distinct tubular wing at the mouth which somewhat recalls the same feature in *Pt. Albersi*, only the tube is more free and open. The only other species possessing a second tube is *S. Mastersi* figured in the Conch. Indica, Pl. V, Fig. 1, but not described. In that species, however, the last whorl towards the mouth is free and the peristomial tube less complete though longer than in the present form.

STREPTAXIS BOMBAX, Bs., Pl. XIV, Fig. 6.

I give an excellent drawing of this species kindly furnished to me by Mr. W. T. Blanford. The species was originally described as *Helix bombax* from an immature specimen. The adult now figured was from the vicinity of Maulmein.

AMPHIDROMUS THEOBALDIANUS, Bs., Pl. XIV, Fig. 8.

A figure is here given of a perfect example of this rare shell, which was described by Benson from an imperfect example.

GEOTROCHUS CALCADENSIS, Beddome, Pl. XIV, Fig. 7.

I also figure a specimen of this species (Beddome, J. A. S. B. 1870, p. 18) forwarded to me by Mr. Bourdillon from Travankor. It is slightly smaller than the type, measuring alt. 20, diam. major 14·80, minor 12·80, aperturæ alt. 11·00, ejusdem lat. 8·00 mm.

UNIO FOOTEI, n. sp., Pl. XIV, Fig. 9.

Testa elongata, rotundato-quadrata, valde inæquilaterali ab umbonibus angulata, et infra et antice valde compressa, concentrice striata et postice

radiatim striata. Dentibus cardinalibus fortibus, in callo costiformi positis, in valva dextra duobus alteraque singulis, subverticalibus. Cicatricibus valde depressis. Pallii impressione valde conspicua.

Diam. maj. 97, *minor* 40, *crass.* 25 *mm.*

Habitat in Kistna flumine prope 'Gutparba falls,' teste A. B. Foote.

This shell has its valves divided into two subequal areas by a strong ridge running back and down from the beaks. The lower and anterior portion is strongly compressed, simulating the appearance of *Arca subtorta*, though there is no true 'version' in the valves. The strong cardinal rib which supports the cardinal teeth is also a marked feature of this species, as well as its radiating striæ intersecting the concentric lines of growth. Unfortunately the beaks are much decayed in my two specimens and their sculpture wholly effaced.

I am indebted to my colleague Mr. Foote for both shells collected by him at the 'Gutparba' falls.

PISIDIUM BOMBAYANUM, n. sp.

Testa subovali, tumida, tenui, inæquilaterali, postice rotundata, viz truncata; antice rotundata elongata; exilissime et confertim concentrice striata; dente cardinali minutissimo; dentibus lateralibus in valva dextra geminis, in sinistra autem singulis.

Lat. 4·30, *alt.* 3·70, *crass.* 2·70 *mm.*

Habitat in Indiæ occidentalis regione "Western Ghats" dicta, teste W. T. Blanford.

I have long had specimens of this shell from Western India, and it is the same as that mentioned by Mr. Nevill when describing his *P. Clarkeanum* (J. A. S. B., 1871, Part II, p. 9, Pl. I, Fig. 4.). The subangulation mentioned by Nevill is more discernible in young shells than in adults, which are symmetrically rounded. This species is extremely closely allied to *P. Clarkeanum*, but is more convex posteriorly. By an inadvertence of the describer the posterior side of *P. Clarkeanum* is described as the longer instead of the anterior as correctly shown in the figure.

PISIDIUM NEVILLIANUM, n. sp.

Testa trigona, tumidiuscula, tenui, inæquilaterali, postice modice convexa, antice elongata, subacuminata, exilissime concentrice striata; umbonibus lævigatis.

Lat. 3·60, *alt.* 3·50, *crass.* 2·20 *mm.*

Habitat prope Rurki.

A single specimen only of this species was communicated to me by Mr. G. Nevill. Its trigonal form most readily distinguishes it from its allies.

PISIDIUM ATKINSONIANUM, n. sp.

Testa subovali, vix tumida, inæquilaterali, antice elongata, utrinque rotundata, tenui, pallide cornea, concentrice striatula, et lineis paucis (4—5) *incrementi fortioribus signata.*

Lat. 3·30, *alt.* 2·70, *crass.* 1·80 *mm.*

Habitat ad Tonglu in Sikkim ad 10000 *ped. alt., teste* W. S. Atkinson.

Compared with *P. Bombayanum* this is a smaller, flatter, and less inæquilateral shell. My specimens were given me by Mr. H. F. Blanford, who received them direct from the discoverer.

XIV.—*Descriptions of new Species of* Blattidæ *belonging to the Genus* Panesthia.—*By* JAMES WOOD-MASON.

PANESTHIA MONSTRUOSA, n. sp.

Ingens, aptera, aterrima, nitida. Corpore crassissimo. Tegumento valde indurato. Pronoto in maribus valdissime, in fœminis modice, inæquali et impresso; bituberculato; incisura profunda, lata, medio recta et linea elevata marginata, lateribus cornigera, cornubus in mare magnis, in femina modicis, reflexis, apice plicatis. Abdominis segmentis basalibus infraque supraque sparsim minute punctatis, ultimo laminaque supraanali punctis crebrioribus necnon grandioribus conspersis hac postice 5-dentata. Pedibus validis, spinis tibialibus fortibus armatis; femoribus anticis trispinosis. Long. corporis maris 58 mm.; pronoti $14\frac{1}{3}$, pronoti lat. $19\frac{1}{3}$, incisuræ lat. 6; mesonoti long. 9, mesonoti lat. $21\frac{2}{3}$; metanoti long. 8, metanoti lat. 23; abdom. long. 30, abd. lat. (ad medium) 23. Long. corp. fem. 52.

HAB.—A male and a female from Southern India (R. C. Beddome).

This fine insect offers a curious resemblance to the *Gromphadorhina portentosa,* Schaum, from Madagascar.

PANESTHIA WALLACEI, n. sp.

Aterrima, nitidissima. Pronoto ut in *P. morione* sed nitidiore et distinctius crebriusque punctato. Abdomine sparsim punctulato, punctis apicem versus sensim frequentioribus ac paullo majoribus; segmento ultimo marginibus integro angulisque posticis vix producto; lamina supraanali disco parce fulvo-pilosa, postice rotundata, tota integra, dentibus lateralibus nullis; lamina subgenitali confertim grosse punctata. Cercis tumidis, fulvo-pilosis. Tegminibus alisque pæne ut in *P. morione;* abdominis apicem longe superantibus; venarum omnium parte apicali perspicua utrinque pallida, subhyalina; illorum vena anali recta impressa hyalina. Femoribus anticis basin versus bidentatis. Long. corporis maris, $36\frac{1}{2}$ mm., pronoti $9\frac{2}{3}$, pronoti lat. 14, long. tegminum 40, alarum 35, abdom. 18, abd. lat. (ad medium) 16.

HAB.—A single male from Sinkep Island, near Singapore.

PANESTHIA FLAVIPENNIS, n. sp.

Aterrima, nitidissima, pulcherrima. Pronoto antice granulato, postice medio sparsim, ad latera confertissime, punctato; aliter ut in *P. Javanico*. Oculis maculisque ocelliformibus flavidis. Tegminibus lætissime flavis, singulis maculis duabus nigris, una parva ad basin, alteraque magna orbiculari pone medium posita, notatis; vena anali elevata potius quam impressa, fortiter arcuata; abdominis segmenti ultimi apicem vix attingentibus. Alis apice flavo-marginatis. Antennis apicem versus flavido-annulatis. Abdominis segmentis dorsalibus punctatissimis; ultimo laminaque supraanali punctis grossissimis: hac margine postico 5-dentata, angulis lateralibus latis: illo angulis posticis acutissime producto; segmentis ventralibus latere punctatis, medio vix punctatis; lamina subgenitali conspicua, lævi, politissima, convexa. Femoribus anticis muticis. Larvis totis aterrimis. Long. corporis ♂ 37—45, ♀ 43 mm.; pronoti ♂ 10—13, ♀ $10\frac{1}{3}$; pronoti lat. ♂ $14\frac{1}{2}$—$17\frac{2}{3}$, ♀ $16\frac{1}{3}$; long. tegminum ♂ 29—53, ♀ $29\frac{1}{2}$.

HAB.—Numerous adult and immature specimens of both sexes from the Nágá Hills (J. Butler and Godwin-Austen), Brahmaputra Valley (A. W. Chennell), and Dikrang Valley (Godwin-Austen).

PANESTHIA SAUSSURII, n. sp.

♀ *P. mandarinea*, Saussure, Mélanges Orthópt., p. 100, Pl. 3, Fig. 23, *non* p. 40, Pl. 1, Fig. 25.

I have recently received from Johore in the Malay Peninsula a fine series of specimens of *P. mandarinea*, none of which exhibit the least approach to the remarkable structure of the abdomen seen in the insect described and figured by De Saussure as the supposed female of it. The larvæ of *P. mandarinea*, moreover, are jet-black throughout, while those of *P. Saussurii* are deep black-brown symmetrically variegated with pale testaceous on every part of the body, including the legs, which are ringed, the antennæ, which are tipped, and the head, which is triply banded, with the same colour. A further reason for refusing to accept the insect figured by De Saussure on Pl. 3 (*op. supra cit.*) as the female of the one represented on Pl. I is, that the latter is itself also a female, the sides of the pronotum in the true males of which are produced into huge curved horns each separated from the broad semioval median lobe covering the head by a deep rounded emargination.

HAB.—A single specimen of the male from Sikkim (L. Mandelli). This insect having been captured just prior to the last moult, the organs of flight are still in rudiment, and the pronotum is still non-emarginate.

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XV.—*Fifth List of Birds from the Hill Ranges of the North-East Frontier of India.*—*By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., Deputy Superintendent Topographical Survey of India.*

(Recd. September;—Read Dec. 6th, 1876.)

(With Plates V, VI, & IX.)

The present list includes birds principally from the Munipur Hills, obtained by Messrs. Ogle and Robert in the field season of 1873—74, by Mr. A. W. Chennell in the Eastern Nágá Hills, and by myself in the Khási Hills in 1875. The above-named members of No. 6 Topographical Survey Party deserve not only my best thanks but those of all interested in ornithology for devoting so much of their spare time to this branch of natural history. Mr. Robert in particular has added a number of new species by his zeal in collecting, and I am glad his name is now associated with one of the most interesting of the birds discovered, *viz.*, a *Sphenocichla.* All the new forms were described in a joint paper by Viscount Walden (now Marquis of Tweeddale) and myself, published in 'The Ibis' in 1875, but I have given the descriptions again in full. During the past winter (1875—76), Messrs. Ogle and Chennell have made another collection in the Nágá Hills, and we may therefore expect a few more novelties, as new country on the eastward has been penetrated and surveyed, and for this purpose many of the higher peaks were ascended and cleared. The people (Nágás) have been most hostile throughout the season, and as it must have been almost impossible for the shikaris to be much about by themselves in the jungle, I do not anticipate a very large collection.

The addition of the following 36 species brings up the record from the eastern districts and hill-frontier to 528 species, a number which, with so many zealous collectors in the party, I trust will be still further augmented before the survey is completed.

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16. Hypotriorchis chicquera, Daud.

From Sylhet.

18. Erythropus (Cerchneis) Pekinensis, Swinhoe.

This specimen was submitted for identification to Mr. Gurney, who says it is too immature in plumage to enable him to decide whether it is really the above or the European species, and who, moreover, doubts the validity of *E. Pekinensis*. But as birds from the Nágá Hills are far more likely to be similar to those from China, I have given it Swinhoe's title, following Jerdon in his 'Supplemental Notes to the 'Birds of India'' in 'The Ibis' for 1871.

25. Accipiter virgatus, Temm.

Obtained by Mr. Chennell near Debrughur.

41*a*. Polioaetus plumbeus, Hodgson.

I have a fine specimen, evidently a female, from the Nágá Hills, agreeing with Dr. Jerdon's description in his Supplementary Notes (*op. supra cit.* p. 336). This was sent for identification to Mr. Gurney, who in reply says—"The one marked *humilis* is *plumbeus* of Hodgson, which I think must be admitted as a good species." Mr. Sharpe, in his 'Catalogue of the Accipitres', does not recognize *P. plumbeus*, but places it as a synonym of *P. ichthyaetus*, considering Hodgson's drawing an unfinished picture of the large species; but Hodgson surely would not have omitted, even in an unfinished drawing, the broad white bar on the tail, the colouration of the tail being the most important character both in *P. humilis* and *P. plumbeus*.

The description of the bird now recorded will run as follows:

On back and shoulder of wing pale umber-brown, with ash-coloured feathers coming in on the centre of back; the tail is of the same colour but darker, increasing in intensity to the end, with no white save at the very roots of the rectrices. Head hoary grey, passing into ashy brown on the nape, with an admixture of some pure plumbeous feathers. The primaries are very dark umber-brown, some of the larger coverts splashed with a more rufous paler brown, the traces of the previous phase of colouration; the first

and second are inside slightly mottled with white on the inner web. Side of head and the chin ashy, passing into hair-brown on the breast. Thighs, abdomen, and under tail-coverts pure white. The lower back has vinous reflections in certain lights.

I have been able to compare this fish-eagle with a male of *P. humilis* from Malacca, and although the plumage is almost identical, save for the greyer tint of the latter, the difference in size is more remarkable. The Nágá bird is in point of size of wing and tail nearly equal *to P. ichthyaetus* but with far feebler bill and talons. *P. plumbeus* would appear to be the more robust Indian representative of the smaller Malayan *P. humilis.*

94. Chelidon Nipalensis, Hodgson.

From Konchungbum.

135*b*. Alcedo Beavani, Walden.

Comparing a very large series of *A. Asiatica* (= *Meninting*, Horsfd.), *A. Moluccensis*, and *A. Beavani*, the distinctly rich lazuline tint of the upper surface in *A. Asiatica* is most apparent. In *A. Moluccensis* and *A. Beavani* this blue has a greenish tinge of torquoise, while beneath *A. Beavani* has the rich sienna-brown of *A. Asiatica.* Such slight differences of colour as those mentioned above are very subtle, but, though in many forms they are very constant when a number of birds are placed side by side, it is quite impossible to settle such fine points of divergence by comparison with coloured plates, as, I notice, is occasionally done. My specimen was obtained on the Sussa river, near Debrughur.

W. 2·67 inches, T. 1·2, F. 0·35, Bf. 1·7.

It agrees exactly with specimens from Cochin China in Lord Walden's collection.

I have examined 23 skins of *A. Asiatica* from the following places, Eastern (Soerabaya) and Western Java, Sarawak, Malacca, Lombok, Togian Islands, Marúp, Penang, Labuan, and Macassa; 6 specimens of *A. Moluccensis*, from Cebebes, N. Ceram, Jololo, and Amboyna (type); and 6 examples of *A. Beavani* from Sadya, Debrughur, the Andamans, Manbaum, Burmah, and Cochin China.

160*a*. Picus atratus, Blyth.

A specimen of this woodpecker obtained at Thingra in the Munipur Hills agrees with Burmese examples. It has been lately figured by Lord Walden in the 'Ibis' for July 1876, in his interesting notes on the late Colonel Tickell's fine series of excellent and truthful drawings of Indian birds, which, with the MSS., have been presented to the Zoological Society of London.

160*b*. Picus manderinus, Gould, var.

This species has for its nearest ally in these districts *P. majoroides*, but the outer tail-feathers are white with narrow black bars, in contradistinction to *P. majoroides*, in which they are black with broad white ones.

Above it is the counterpart of *P. majoroides:* the back, wing, and tail rich velvety black; spots on the wing-feathers moderate; a very large and conspicuous white wing-patch formed by the secondary coverts; a scarlet band on the nape; a white frontal band extends through the eye to the ear-coverts and side of the neck, the portion near base of bill and the ear-coverts being pale flaxen. Beneath: the chin white; throat and upper breast earth-brown, with a pale scarlet gorget bordering a black patch, which, commencing at the gape, widens and extends down the side of the neck, a few pure white feathers separating this from the earth-brown of the throat; flanks white; the tail has the two outer feathers white, barred with black on inner web, the outermost has two spots on the white outer web, and in the penultimate this web is entirely white; tips of the four outer tail-feathers ferruginous; the abdomen and under tail-coverts are crimson. Bill dark plumbeous, rather stouter and blunter than that of *P. majoroides;* legs equal in size.

L. about 8 inches, W. 5·0, T. 3·68, t. 0·85, Bf. 1·17.

Hab.—Was obtained by Mr. Wm. Robert at Gonglong, Munipur Hills.

It differs from *P. manderinus*, Gld., in being smaller, in the white on the wings being more conspicuous, in being browner on the throat and breast, and in its whiter tail. In the specimen of *P. manderinus* in the British Museum with which I compared it, the outer web of the penultimate tail-feather has a black spot.

238*a*. Dicæum olivaceum, Walden.

A specimen from Samaguting turns out to be identical with those from Tonghu, Burmah. Blyth must have been mistaken when he says he saw *D. minimum* in abundance at Moulmein: the species he saw must have been either *D. virescens* or *D. olivaceum*, probably the former.

245. Certhia discolor, Blyth.

L. about 5·75 inches, W. 2·54, T. 2·9, t. 0·60, Bf. 0.58.

Naga Hills.

248. Sitta Himalayensis, Jard. and Selby.

Aimul, Munipur Hills.

There are several skins in the collection. Interesting as being the first record of this nut-hatch so far to the eastward.

W. 3·0 inches, T. 1·70, t. 0·65, Bf. 0·60.

303. CYORNIS UNICOLOR, Blyth.

This bird, hitherto only obtained in Sikkim, I have from the Khasi Hills. Among Col. Tickell's drawings there is one of this species under the title *Eumyias melanops* (*vide* Lord Walden in op. supra. cit., p. 353), shewing that it extends southwards into Akyab.

317. ANTHIPES MONILIGER, Hodgson.

Gonglong, Munipur Hills.

332*a*. PNOEPYGA ROBERTI, Wald. and Aust.

The following is the original description of this species published in 'The Ibis' for 1875, p. 252.

"Above olive-brown, each feather pale-centred and fringed or tipped with dark brown. Lores albescent. Between the eyes and the rictus black. A well-defined streak extending from above the eye down each side of the head, fulvous. Ear-coverts cinereous at base, brown towards the tips. Chin and throat pure white, each throat-feather being terminated by a small black triangular drop; as the tips of the feathers overlap, these drops from continuous black lines, the two principal ones descending from the angles of the under mandible. Cheeks ferruginous, each feather with a black terminal drop. Pectoral and abdominal feathers pale brown, with broad pure white or fulvous-white centres. Under tail-coverts bright ferruginous yellow. Plumage on the rump loose, soft, and dense, completely concealing the short tail, and being of an almost uniform ferruginous brown colour. Wings when closed, dark chocolate-brown, most intense on the secondaries. Most of the wing-coverts distinctly tipped with almost pure white, so also the inner tertiary quills. Rectrices chocolate-brown."

"Bill from nostril 0·37 inch, wing 2·15, tarsus 0·75, tail 1·15."

This bird was found at Asalú and also at Chakha in the Munipur hills. In my first list it is recorded under the name of *Pnoepyga caudata*, Blyth. It closely resembles *Turdinus brevicaudatus*, especially in the upper plumage, but may be at once distinguished by its smaller size and diminutive tail.

332*b*. PNOEPYGA CHOCOLATINA, Wald. and G-Aust.

Described in 'The Ibis,' Vol. V, 1875, p. 252, as follows:—

"Above olive brown, each feather fringed with a somewhat fainter tint, thus imparting a subdued scaly aspect to the back. Wings and tail chocolate-brown. Upper and under tail-coverts ferruginous brown, brightest on the under coverts. Lower surface generally ferruginous brown, many of the abdominal feathers being largely centred with white or fulvous white. Pectoral feathers with minute terminal white drops, or some with narrow

white or fulvous white centres. A few almost white feathers on the middle of the breast. Chin white; gular feathers white, with pale fulvous or ferruginous edges. Bill dark brown. Legs pale flesh-colour."

"Bill from nostrils 0·25 inch, wing 1·87, tarsus 0·75, tail 1·75."

"Described from a specimen obtained at Kedimai in the Munipur Hills."

Having obtained specimens of this bird at Shillong in June 1875, I can add a few additional notes from birds in the flesh. The specimen first described is evidently in an immature stage of plumage. In the adult, the lores are pale over the eye also, the border of lower mandible is white, the under surface is more rufous, there is no sign of white tippings to the breast or abdominal feathers, the irides are red-brown, and the legs pale horny.

In the Jardin des Plantes at Paris, where Mr. Oustalet very kindly got out for my inspection the fine series of birds collected by Père Armand David in Moupin, Setchuan, &c., there is a *Pnoepyga* very close to this form, the *P. Halsneti* of A. David, which is speckled all over with whitish on a pale umber-brown, has a pale rufous moustachial streak, a white throat, and a finely barred tail.

335. Rimator malacoptilus, Blyth.

Munipur Hills.

362. Merula albocincta, Royle.

Remta, Munipur Hills.

W. 5·65 inches, T. 4·1, t. 1·5, Bf. 0·78.

367*a*. Turdus pallidus, Gmelin.

375. Paradoxornis ruficeps, Blyth.

Hemeo Peak, North Cachar.

377. Chlenasicus ruficeps, Blyth.

Baladhan, Cachar.

378*a*. Suthora Munipurensis, G-Austen and Walden.

Described in 'The Ibis' for 1875, p. 250 as follows:—

"Crown of head cinnamon-brown, becoming more olivaceous or fulvous green on back; shoulder of wing greenish umber. Primaries black, the first four edged white, the rest crossed with a bright fulvous bar on the outer webs; the secondaries edged broadly with fulvous, and a few of the last tipped white on inner web. Tail ruddy fulvous at base, paling towards the end, which is dusky and indistinctly barred, a broad supercilium

black, lores and narrow circle round the eye pure white. Ear-coverts and side of neck grey; chin and throat black, merging into pearly grey and white on the breast; under tail-coverts pure white."

"Length 4·5 inches, wing 1·8, tail 2·4, tarsus ·77, bill at front 0·28."

This is another fine species discovered by Mr. Wm. Robert, near Kara-Khul, in the Munipur Hills. Several more specimens were shot in the following field-season by Mr. Chennell, in the Eastern Nágá Hills. A second species very close to it was discovered by myself in the Dafla Hills, and named *S. Daflaensis.* This may be known by its smaller size, far brighter crown, and grey chin instead of the jet black one of *S. Munipurensis.*

386*a*. Pyctorhis altirostris, Jerdon. Plate IX.

I have alluded to this species in my 'List of Birds from the Dafla Hills.' There is I find a specimen among the birds collected the same season by Mr. A. Chennell in the neighbourhood of Sibsagar. For some time I failed to discover what had become of the type, but, Mr. Sharpe having since found it in the British Museum and very kindly called my attention to it, I have been enabled to compare my specimen. I do not hesitate to pronounce the two the same, although Dr. Jerdon's specimen is somewhat different in colouration, being whiter on the chin and upper breast; it is, however, paler throughout and appears to me to have faded considerably, having all the appearance of having been packed in a damp state, with perhaps some carbolic powder. Some skins of mine that got damp in transit to Calcutta, I noticed, lost much of their brilliancy. The dimensions are the same.

This bird ought to be found again in the high grass of upper Burmah, and no doubt would be found, if zealously looked for.

388*a*. Alcippe fusca, n. sp.

Above—head and nape dull grey; back olivaceous ochre, richer and more ochraceous on the rump. Tail umber-brown edged with the same colour as the back. Wing rich ochry brown, fulvescent ochre inside as well as on the flanks and thighs. Ear-coverts dull brown, chin sullied white. Bill and legs horny. Irides?

L. about 5·75 inches, W. 2·85, T. 2·7, t. 0·87, Bf. 0·47.

The above dimensions taken from skin.

Hab.—Four specimens were obtained by Mr. A. W. Chennell in the Nágá Hills.

Having remembered to have seen a very similar bird in the Jardin des Plantes, I forwarded a specimen to M. Oustalet, who very kindly examined it and gave me the following particulars:—It has a strong likeness to an *Alcippe* from Fokien named by M. A. David, *Alcippe Hueti;*

the tint of the head, back, and abdomen are nearly the same, but there are differences worthy of notice. 1st, *A. Hueti* has the bill decidedly shorter than *A. fusca*, 11 millims. instead of 13, taking the measurement along the culmen, and 14 instead of 18, from the gape; the tarsus having the same dimensions in the two birds. 2ndly, the chin and the upper part of the breast are pure grey, and not pale fulvescent *(fauve clair)*, as in *A. fusca*. 3rdly, the tint of the flanks is less fulvescent ochre, more mixed with green. 4thly, the internal webs of the tail-feathers are scarcely darker than the external, instead of being blackish as in *A. fusca*. Lastly, the wing is shorter, 0·65 mill. against 0·72 mill. M. Oustalet is of opinion that the two are quite distinct though closely allied, *A. Hueti* being nearer to *A. Nipalensis*. Another close form is *A. Morrisonia* from Formosa, which differs in being more rufous above, grey-cheeked, and smaller.

391*a*. SPHENOCICHLA ROBERTI, Wald. and G-Aust. Plate VI.

The original description in 'The Ibis' for 1875, p. 251, is as follows:—

"General colouration throughout dark umber-brown, richer on the wings and tail, which are closely barred with black; feathers of the nape and back edged with darker brown, and with an inconspicuous pale spot near tip; these spots are more defined on the side of the neck. The feathers of the throat, neck, and breast are lanceolate, with a white edging showing as V-shaped markings; towards the abdomen these become less conspicuous, and only a few white spots dot the flanks. Bill grey, pale beneath and at tip.

"Length about 6·5 inches, wing 2·8, tail 3·0, tarsus 0·93, bill at front 0·87, depth at base 0·40.

"Shot on Hemeo* Peak, North Cachar hills, and also in the Munipur Hills."

A second species of this new genus from the Nágá hills was a highly interesting prize, and it is one of the finest things for which we are indebted to Mr. Wm. Robert. The form from the Darjeeling hills is quite distinct: is a much smaller bird, without any V-shaped markings on the side of the neck and breast, and of a different tint of brown; the bill, moreover, is not so compressed and wedge-shaped above—a character that links it to *Stachyris nigriceps*, which in its dark coloured head approaches the same kind of colouration.

406. XIPHORHAMPHUS SUPERCILIARIS, Blyth.

Konchungbum Peak, Munipur Hills. Similar in every respect to the Darjeeling bird.

* *Hemes* by mistake in the 'Ibis.'

498. Ruticilla Hodgsonii, Moore.

From the Eastern Nágá Hills.

♂ L. about 6 inches, W. 3·28, T. 2·85, t. 0·90, Bf. 0·40.

A young female is thus described in my note-book :—

Olive brown above, upper tail-coverts and tail pale rufous, central feathers brown. Wing umber-brown, the primary coverts faintly tipped dusky; the outer and basal half of the secondaries white. Throat and upper breast dusky brown; whitish on the middle of the abdomen; under tail-coverts very pale rufous.

W. 2·85 inches, T. (frayed) 2·3, t. 0·9, Bf. 0·45.

541. Cisticola Tytleri, Blyth.

Sengmai, Munipur valley.

Compared with the type from Dacca in the Indian Museum, Calcutta.

This is a very distinct species, with very pale ochre head and breast, and tail black both above and below.

552*b*. Niornis albiventris, n. sp.

Above—dark rich umber-brown, paler on the shoulder of the wing; tail and wing of same colour. Chin sullied white, each feather slightly tipped dusky; the throat greyish white; upper breast crossed by a band of pale rufous; lower breast and abdomen white; flanks rufescent brown; under tail-coverts rusty; pale rusty inside the wing. A palish circle round the eye. Bill horny brown above, pale beneath. Irides?

L. about 4·75 inches, W. 2·1, T. 2·2, t. 0·87, Bf. 0·45, hind toe and claw 0·58, mid toe and claw 0·80.

Hab.—Sengmai, Munipur valley. Obtained by Mr. W. Robert.

It is very close to *Niornis assimilis*, Hodgson, but is larger and more strongly built, and of darker plumage throughout, for whereas the latter is of a greenish hue generally, the above form is rufescent. The tarsi and feet are particularly strong and the mid-toe very long. The bill is identical as regards the nostrils, but is rather deeper and stronger.

610. Pterythrius rufiventer, Blyth.

619*a*. Minla rufigularis, Mandelli, S. F., p. 416, July 1873.
M. collaris, Walden, August 1874.

Included in 'List of Dafla Birds.'

Until our bird is compared with Mr. Mandelli's from Darjeeling we do not know for certain that they are identical.

619*b*. Minla Mandellii, Godwin-Austen.

Was described in the Ann. and Mag. Nat. Hist. January 1876, and included in the 'List of Birds of the Dafla Hills', with full description. It is a very common bird in the Nágá hill-ranges. I noticed a bird in the collection at the Jardin des Plantes from Western China very closely allied to these two species, named by A. David *Ixulus superciliaris:* the head above brown; back greyish olivaceous; tail dull rufous brown; a black supercilium from behind the eye to the nape; lores pale; throat and breast dull white; flanks greyish.

686*a*. Acridotheres albocincta, Wald. and Aust. Plate V.

Is thus described in 'The Ibis' for 1875, p. 251:—

"Top of head glossy black, feathers rather elongated, and a white collar on back of neck; back dull grey-black, with a slight green tinge, and with a tendency to purple on the shoulders and wing-coverts. Tail black with green reflections. Primaries black, white at base, forming a wing-band; secondaries warm sepia-brown. Beneath dull but dark greenish grey. Upper tail-coverts black, tipped white, and arranged in bars. All the tail-feathers tipped with white, except the two centre ones. Bill and legs yellow.

"Length about 9 inches, wing 5, tail 3·5, tarsus 1·4, bill at front 0·91."

Appears numerous in the Munipur valley, where it was obtained by Mr. Wm. Robert, another important discovery by that indefatigable collector.

727. Mycerobus melanoxanthus, Hodgson.

From Konchungbum, Munipur, obtained by Mr. Wm. Robert.

♂	W. 4·9 inches,	T. 3·2,	t. 0·82,	Bf. 0·85.
♀	4·6 „	2·8,	0·80,	0·83.

736. Propyrrhula subhemachala, Hodgson.

Remta, Munipur.

750. Chrysomitris spinoides, Vigors.

From Khajinghon, Munipur.

867. Scolopax rusticola, Lin.

The woodcock was now and then flushed in the woods of the Nágá Hills, but was not common.

Additional notes on the Birds of previous Lists.

MICRONISUS BADIUS, Gmelin.

There are in the collection two specimens, one an adult and one in immature plumage, from the Eastern Nágá Hills. Jerdon remarks that there is a dusky reddish nape, only conspicuous when the head is bent forwards: in my specimen this is far more pronounced and forms a dull rusty band quite half an inch wide. In the young bird this rusty band is also to be seen coming in on the sides of the neck but not quite meeting in the middle, agreeing with a description of an adult by Mr. A. O. Hume in his 'Scrap Book,' p. 121.

205. HIEROCOCCYX VARIUS.

Of 'Fourth List' should be *H. sparverioides*, Vigors.

SIPHIA SUPERCILIARIS, ♀.

I refer a specimen from the Nágá Hills to the female of the above, and give a description of it, as none is to be found in Jerdon, among whose collection of drawings is a figure of the same sex with dimensions.

Above—head and back dullish olivaceous green; wing umber-brown with rather strong rufous edgings; tail the same colour, with only the faintest rufous tinge. Chin dull pale ferruginous; breast darker, with a sordid green tinge on the flanks; under tail-coverts white, as also the extreme base of both webs of the outer tail-feathers, which in this respect assimilate with those of the male, where we find a greater extent of white.

	L.	W.	T.	t.	Bf.
Nágá Bird: about	4 inches,	2·2,	1·65,	0·67,	0·37.
Dr. Jerdon's measurements.	$4\frac{1}{4}$,,	$2\frac{3}{16}$	$1\frac{5}{8}$,	$\frac{11}{16}$,	$\frac{3}{4}$.

MUSCICAPULA ÆSTIGMA, Hodgson. ♀

I am indebted to Mr. A. W. Chennell of the Topographical Survey for this specimen. I had previously obtained several males at Shillong Peak and in the forest near Mairang, but had never secured a female. Dr. Jerdon had apparently seen the male only, for no description of the female is given by him.

Above ashy, with an olivaceous tinge, rather rusty near base of bill; wings and tail plain umber-brown. Beneath sordid white.

W. 2·22 inches, T. 1·6, t. 0·61, Bf. 0·35.

VOLVOCIVORA MELASCHISTOS, Hodgson.

As the description of immature forms is of great interest, and as none is given in the 'Birds of India,' I append one of a young male of this species obtained at Shillong.

Above—pale ochraceous mottled with black on the head, barred with the same on lower part of back, each feather having a subterminal black band, grey at base; primaries and secondaries, especially the latter, are all tipped cream colour, as well as the primary and lesser coverts, forming two distinct bands; tail-feathers all tipped white, the outermost broadly so. Beneath—greyish white tinged with pale rusty and barred pale grey.

This young bird was shot about the middle of June.

PARADOXORNIS AUSTENI, Gould.

Extends into the mountain region of Western China. Examples were obtained by Père Armand David, and are in the collection at the Jardin des Plantes.

LAYARDIA RUBIGINOSUS, G-Austen.

In the dimensions given of this bird, in 'Fourth List' (J. A. S. B. Pt. II. 1874 p. 164), the tarsus should be 1·16 not 1·6 inches.

532. PRINIA FLAVIVENTRIS.

Lord Walden, in his Supplemental Notes to Blyth's Catalogue of the Birds of Burmah (J. A. S. B., 1875, p. 118), alludes to the presence of a well-marked white supercilium in examples of this species from Munipur; it is not, however, a constant character even there. Among the specimens last obtained near Tezpur, Assam valley, some have the whole side of the head dark grey even to the lores, and noticing the variation I made a drawing of it at the time from a fresh bird. We thus have an interesting gradation from this state of plumage into one with pale lores and yet another where this is developed into a well marked supercilium.

IXULUS STRIATUS, Blyth.

Of "First List," p. 109, is *Ixulus castaniceps*, Moore.

IXULUS CASTANICEPS.

Of 'Fourth List,' p. 169, is a new species. Dr. Jerdon, who had never seen true *Ixulus castaniceps* described by Moore, when looking over my first collection at Cherra Poonjee, gave it the above title. I have since described it under the name of *Minla Mandellii* in Ann. Mag. Nat. Hist. Jan. 1876, and the description has been repeated in full in the 'List of Birds from the Dafla Hills'. It may after all be Mr. Hume's *Proparus dubius*.

SPHENOCERCUS SPHENURUS, Vigors.

In the collection under review, specimens of this bird have red feet and legs, as described in Jerdon; curiously enough, however, Khasi Hill birds, obtained near Shillong in May, have them yellow, and hence it was that when recording the specimens in my field-note-book, I entered them under the genus *Crocopus:* in no other point can I detect the slightest difference.

795. TURTUR SURATENSIS, Gmelin, white var.

This very pretty albinoid variety is rather smaller in size than ordinary specimens. It is white throughout, the black of the nuchal patch with the white spots being replaced by pale ash-grey, as well as the darker portions of the wing and base of the tail-feathers. This interesting variety was shot at Lakhipur in Kachar.

82. ARBORICOLA TORQUEOLA, var.

In my last list I recorded a female of *A. rufogularis* from the Nágá Hills, no male having been seen. Among Mr. Robert's birds there are several fine wood-partridges with red heads, and from the same locality another female similar to the one I got under Japvo Peak in 1872—73. This I now refer to *A. torqueola*, instead of to *A. rufogulare*, the place of which in the list must be taken by the former name. Compared with *A. torqueola* from the Simla Hills, N. W. Himalaya, there are several small but well-marked variations, entitling the Nágá bird to be considered a variety. The legs of the above-mentioned female are, I find, recorded in my field-book as pale fleshy violet, and if Jerdon is right in giving *red* as the colour of those of *A. torqueola* (which I find is the colour noted of a specimen of *A. intermedia* from the Nágá Hills obtained at the same time and place), the Nágá bird would be worthy of a new title. Do the legs of the males and females differ?

347. HYDROBATA ASIATICA, Swainson.

This bird is pretty numerous in the streams that flow from the peak of Shillong. Jerdon does not mention the remarkable white circle round the eyes. The adult plumage is as follows:—

Above—dark dull umber-brown; beneath and sides of head sooty black. A lunular white patch both above and below the eye, the lower being the larger; this is its most characteristic point, and it is very conspicuous in the living bird, but in a badly skinned specimen is not to be made out. Irides dark brown. Legs dark brown; the scutæ in front of tarsus pale leadgrey. Bill black.

Length about 8 inches, W. 3·8, T. 2·4, t. 1·3, Bf. 0·87.

During the months of May and June, great numbers of different species of *Drymoecinae* are to be found breeding on the high grass-lands of

the Khasi Hills, and I came upon a large number of their prettily constructed nests, and secured the eggs of *S. fuliginosa*, *Cisticola schœnicola*, *Prinia Hodgsoni*, &c., the old birds of which I shot at the time. These nests were generally about two feet above the ground, and constructed of fine grasses, the leaves and stems of which were all drawn in together and the leaves often threaded through with the finer fibres.

XVI.—*Contributions towards a Knowledge of the Burmese Flora.* *By* S. Kurz.

(Continued from Vol. XLIV, p. 190).

SABIACEÆ.

Conspectus of Genera.

1. Sabia. Stamens 4—5, all perfect. Ovary 2—3-lobed. Drupes usually compressed.

2. Meliosma. Stamens 5, very unequal. Ovary 2—3-celled. Drupes more or less globose.

Sabia, Coleb.

Conspectus of Species.

* *Glabrous. Flowers panicled.*

Flowers about a line across, the pedicels short and thick; leaves coriaceous, *S. limoniacea.*

Flowers nearly 4 lin. in diameter, the pedicels capillary and long; leaves membranous,.. *S. viridissima.*

* * *Branchlets and leaf-nerves beneath tomentose; panicles glabrous, S. tomentosa.*

1. S. limoniacea, Wall. Cat. 1000; Hf. Ind. Fl. II. 3.—(*S.* sp. Griff. Not. Dicot. 423. t. 568. f. 2).

Hab. Chittagong.

2. S. viridissima, Kurz in Journ. As. Soc. Beng. 1872, 304; Hf. Ind. Fl. II. 3.

Hab. Not unfrequent in the tropical forests of South Andaman, especially along the western coast.—Fl. May.

Meliosma, Bl.

1. M. simplicifolia, Bl. in Rumph. III. 197; Miq. Fl. Ind. Bat. I/2 613; Hf. Ind. Fl. II. 5 (*Millingtonia simplicifolia*, Roxb. Corom. Pl. III. t. 254 and Fl. Ind. I. 103; Griff. Not. Dicot. 162. t. 442; *Sabia? floribunda*, Miq. Suppl. Fl. Sum. 521).

Hab. Tropical forests of Tenasserim, from Moulmein southwards; Ava hills; also Chittagong.—Fl. March, Apr.

Dr. Hooker is in error with regard to the geographical distribution of this species. It occurs not only in Malaya, but also in Hindustan (No. 544 of Wight's Distr. being in my opinion the typical plant).

ANACARDIACEÆ.

Conspectus of Genera.

Trib. I. ANACARDIEÆ. Ovary 1- very rarely 2-celled.

* *Leaves ternately or pinnately compound (in a very few species not Burmese also simple).*

× Calyx in no way enlarging after flowering.

\+ Ovule suspended from near the summit of the cell.

1. Odina. Petals 4—5, imbricate in bud. Stamens 8—10. Styles 3—4 in the male flowers, the ovary 4—5-parted.

\+ + Ovule suspended from a free erect basilar funicle.

2. Rhus. Petals 4—6, imbricate in bud. Stamens 4—10. Styles 3. Leaves compound, very rarely simple. Trees or shrubs.

3. Tapiria. Petals 5, imbricate in bud. Stamens 10. Styles in female flowers singly and short, in the males 4—5. Climbers.

× × Calyx-lobes much enlarging and becoming leafy and wing-like.

4. Parishia. Flowers 4-, rarely 3-merous. Stamens 4, rarely 3. Style 3-cleft at the summit.

* * *Leaves simple.*

× Petals variously enlarged under the fruit.

5. Swintonia. Sepals 5. Stamens 5. Drupe sessile and subtended by the wing-like spreading petals.

6. Melanorrhœa. Calyx spathaceous, 5-parted. Stamens numerous. Drupe stalked and subtended by the wing-like spreading petals.

× × Petals not enlarging after flowering.

\+ Calyx-tube much enlarging and becoming fleshy, either bearing the superior nut or more or less enclosing the same and forming an inferior drupe.

† Nut more or less enclosed in the fleshy calyx. Ovary inferior.

7. Drimycarpus. Petals imbricate in bud. Stamens 5. Style 1, with a capitate stigma.

8. Holigarna. Petals valvate in bud. Stamens 5. Styles 3. Disk annular or obsolete. Petiole furnished with 2—4 tubercles or barb-like excrescences.

† † Nut seated on the much enlarged fleshy calyx-base. Ovary superior.

9. Semecarpus. Petals imbricate or valvate in the bud. Stamens 5. Styles 3. Disk rather broadly annular. Petiole without excrescences.

10. Anacardium. Petals imbricate in bud. Stamens 8 to 10, all or few of them anther-bearing. Style filiform. Torus stalk-like.

\+ + Calyx unchanged in fruit. (Ovules pendulous from a basal funicle).

11. Buchanania. Calyx 3- to 5-toothed. Stamens 10. Carpels 5 or 6, of which one only fertile. Styles as many, short.

12. GLUTA. Calyx spathaceous. Stamens inserted on the stalk-like torus. Style filiform.

13. BOUEA. Calyx 3- to 5-parted, valvate in bud. Stamens 3—8, all anther-bearing. Style short. Leaves opposite.

14. MANGIFERA. Calyx 4—5-parted. Petals 4—5, the nerve usually thickened. Anther-bearing stamens 1—5. Style filiform. Leaves alternate.

Trib. II. SPONDIEÆ. Ovary 2—5-celled. Ovules pendulous. Leaves pinnate.

15. SPONDIAS. Flowers polygamous. Stamens 8 or 10. Styles 4 or 5, free at the summit.

16. DRACONTOMELUM. Flowers hermaphrodite. Stamens 10. Styles 5, thick, connate at their summits and resembling ovaries.

Odina, Roxb.

1. O. WODIER, Roxb. Fl. Ind. II. 293; Royle Ill. Him. Pl. t. 31. f. 2; Wight Icon. t. 60; Bedd. Fl. Sylv. t. 123; Hf. Ind. Fl. II. 29.

HAB. Common all over Burma and adjacent islands, especially in the leaf-shedding forests of all kinds.—Fl. Febr. March; Fr. Sept. Octob.

Rhus, L.

Conspectus of Species.

* *Leaves 3-foliolate.*

Glabrous, the leaflets entire, ... *R. paniculata.*

* * *Leaves unpaired-pinnate.*

Tomentose, the leaflets serrate-toothed, in 4—6 pairs; endocarp smooth and bony, ..*R. Javanica.*

Petiole very slender and glabrous, the leaflets in 8—12 pairs, incised-serrate; endocarp fibrous, ... *R. Khasiana.*

1. R. PANICULATA, Wall. Cat. 993; Hf. Ind. Fl. II. 10.

HAB. Not uncommon in the eng-forests of Prome; also Ava.—Fl. Sept.; Fr. Jan.

2. R. JAVANICA, L. sp. pl. 380; Brand. For. Fl. 119. (*R. semialata*, Murr. Comm. Goett. VI. 27. t. 3; Hf. Ind. Fl. II. 10; *R. Bucki-amela*, Roxb. Fl. Ind. II. 99; Wight Icon. t. 561).

HAB. Not unfrequent in the drier hill-forests and the hill-eng-forests of Martaban, east of Tounghoo, up to 3000 ft. elevation; also Ava.—Fl. Sept., Oct.; Fr. Apr.

3. R. KHASIANA, Hf. Ind. Fl. II. 10.

HAB. Chittagong (*teste* Hook. f.).

Tapiria, Juss.

1. T. HIRSUTA, Kurz in Journ. As. Soc. Beng. 1870, 75; Hf. Ind. Fl. II. 28. (*R. hirsuta*, Roxb. Fl. Ind. II. 455; Kurz in Journ. As. Soc. Beng. 1870, 75).

HAB. Chittagong, Ava, Khakyen hills (J. Anderson).

Dr. Hooker claims authority for the name, citing the *Genera Plantarum*, where nothing of the kind occurs.

Parishia, Hf.

1. P. INSIGNIS, Hf. in Linn. Trans. XXIII. 169. t. 26 and Ind. Fl. II. 30.

HAB. Frequent in the tropical forests of the Andamans; also in Southern Tenasserim.—Fr. May.

Swintonia, Griff.

Conspectus of Species.

× *Leaves opaque and glaucous beneath.*

Pedicels $\frac{1}{2}$—1 lin. long; petals hardly a line long; drupes oblong, ... *S. Schwenckii.*

× × *Leaves one-coloured and glossy.*

Leaves greyish green, the nerves and net-venation conspicuous; pedicels 3—5 lin. long; petals 2 lin. long, ... *S. Griffithii.*

Similar to the above, but leaves dark-brown, the net-venation obsolete; drupes obovoid, ... *S. Helferi.*

1. S. SCHWENCKII, Teysm. and Binnend. Cat. Hort. Bog. 230 (line 13 from below); Hf. Ind. Fl. II. 26 (*Astropetalum* sp. 2 Griff. Not. Dicot. 412 *teste* Hf.).

HAB. Common in the tropical forests of the eastern slopes of the Pegu Yomah and from Martaban down to Tenasserim; also Chittagong.—Fl. Feb.—Apr.; Fr. May.

2. S. GRIFFITHII, Kurz in Journ. As. Soc. Beng. 1870, 75; Hf. Ind. Fl. II. 26. (*Astropetalum* sp. 1. Griff. Not. Dicot. 411 t. 565. f. 2. b—d, *teste* Hf.).

HAB. Tenasserim, Mergui (Griff. 1124).

3. S. HELFERI, Hf. Ind. Fl. II. 26.

HAB. Tenasserim (Helf. 1122).

Melanorrhoea, Wall.

Conspectus of Species.

Leaves glabrous; panicles usually minutely puberulous; fruit-stalk nearly $1\frac{1}{2}$ in. long, slender, ... *M. glabra.*

Leaves beneath and panicles pubescent or villous; fruit-stalk short and thick, .. *M. usitata.*

1. M. GLABRA, Wall. Pl. As. rar. III. 50. t. 283; Hf. Ind. Fl. II. 25.

HAB. Tenasserim, in forests from Tavoy southwards.—Fl. Decb.

2. M. USITATA, Wall. Pl. As. rar. I. 9. t. 11-12 and in Journ. As. Soc. Beng. VIII. 70. c. tab.; Sering. in Bull. Bot. II. 38. t. 4; Hf. Ind. Fl. II. 25. (*M.* sp. Griff. Not. Dicot. 409 ?).

HAB. Common in the open, especially the eng- and hill-eng-forests, but rare in the dry forests, from Prome and Martaban down to Tenasserim, up to 2000 ft. elevation; also Ava.—Fl. March; Fr. Apr., May.

Drimycarpus, Hf.

1. D. RACEMOSUS, Bth. and Hf. Gen. pl. I. 424; Hf. Ind. Fl. II. 36. (*Holigarna racemosa*, Roxb. Fl. Ind. II. 82).

HAB. Not unfrequent in the tropical forests of the eastern slopes of the Pegu Yomah; also Chittagong.—Fl. Febr., March; Fr. Jun., July.

N. B.—The genus hardly differs from *Nothopegia* except in the free ovary and in the attachment of the ovules, and stands much in the same relationship to it as *Holigarna albicans* does to *Semecarpus*.

Holigarna, Ham.

Conspectus of Species.

Leaves glabrous or rarely pubescent beneath; nut entirely enclosed in the obliquely ellipsoid or elliptical perfectly glabrous calyx of an inch length, ... *H. longifolia.*

Leaves usually pubescent beneath and glabrescent, rarely glabrous; male flowers nearly twice as large as those of the preceding; drupe obovoid, tomentose while young, the apex of the nut exposed and forming a convex disk, ... *H. Grahamii.*

2. H. GRAHAMII, Kurz in Journ. As. Soc. Beng. 1872, 205; Hf. Ind. Fl. II. 37.

VAR. *a.* GENUINA. (*Semecarpus Grahamii*, Wight, Icon. t. 235).

VAR. *β.* HELFERI. (*H. Helferi*, Hf. Ind. Fl. II. 37; *H. longifolia*, Hf. Ind. Fl. II. 37 and Roxb. Corom. Pl. III. 76 t. 282. the male plant and Fl. Ind. II. 80 quoad plant. masc. e Chittagong).

HAB. Var. *β.* Frequent in the tropical forests of the Pegu Yomah and the Martaban hills east of Tounghoo.—Fl. March; Fl. Apr., May.

The Hindustani tree has the nut much more exserted and broader. But those of my Burmese plants, though not yet ripe, already shew the obovoid development. *H. Helferi*, Hf. Ind. Fl. l. c. from Mergui (Helf. 1133) is in my eyes only a glabrous form of the above. Dr. Hooker assumes that I have mixed up this species and his *Holigarna albicans*. On reference to a list of Burmese plants sent to me by him, I find that, of the numbers 2014, 2016, and 3328, the first, marked by myself as *Holigarna Grahamii*, as also the remaining two, have been referred at Kew to *H. Grahamii*, but of these No. 2016 is my *Semecarpus albescens*, while No. 3328 (marked at Kew as fruits of *H. Grahamii*) is presently not at hand, and the high number would bring it amongst monocotyledons.

Roxburgh carefully separated his two trees (the Chittagong one and the Hindustani one), describing them separately, and remarked that Hamilton had given the generic name to the Hindustani tree. Wight and Arnott are, therefore, quite correct in identifying with Roxburgh's their tree, which Hooker now rechristens *H. Arnottiana*. I possess flowering

and fruiting specimens of Roxburgh's trees in the H. B. C., collected before the destructive cyclone of 1864, which shew that the Chittagong tree of Roxburgh is *H. Helferi*, and that the Hindustani one is the same as Wight's Herb. No. 569 and consequently *H. Arnottiana*, Hf. The fruits are described and figured as much too ovate. If the ripe fruits and the stigmas of the Burmese species should turn out to be different, Hooker's name *(S. Helferi)* would have to be restored.

Semecarpus, L. f.

Conspectus of Species.

A. Nut adnate to the hypocarp, barely exserted. Ovary superior.

Leaves glabrous or pubescent and whitish beneath; nut velvety, the hypocarp sappy, veined, and puberulous, ... *S. albescens*.

B. Nut seated on the hypocarp.

* *Ovary tomentose or pubescent.*

× Hypocarp (enlarged base of the calyx) as large or nearly as large as the nut.

Leaves coriaceous, blunt, densely pubescent or tomentose and strongly net-veined beneath; nut not or scarcely oblique, ... *S. Anacardium*.

Leaves (fullgrown) chartaceous, sharply acuminate, softly pubescent beneath, the net-venation faint; nut very oblique, ... *S. panduratus*.

× × Hypocarp very small.

Leaves coriaceous, acuminate, quite glabrous or pubescent and very glaucous beneath, the net-venation strong; nut very oblique, $1\frac{1}{2}$—1 in. across, ... *S. heterophyllus*.

* * *Ovary quite glabrous.*

A tree; leaves chartaceous, acuminate, glabrous; panicles quite glabrous; nut an inch broad, ... *S. subpanduriformis*.

A simple-stemmed shrub with a large subterranean trunk; leaves chartaceous, minutely pubescent beneath and glabrescent; panicles densely puberulous; nut only 3—4 lin. long, ... *S. subracemosus*.

1. S. ALBESCENS, Kurz in Journ. As. Soc. Beng. 1871, 51; Hf. Ind. Fl. II. 35. (*H. albicans*, Hf. Ind. Fl. II. 38 excl. syn; *Semecarpus heterophyllus*, Hf. Ind. Fl. II. 35, non Bl.).

HAB. Not unfrequent in the tropical forests of the Pegu, and the Martaban hills, east of Tounghoo, down to Tenasserim (Helf. 1131).—Fl. Jan. Febr.; Fr. March, Apr.

2. S. ANACARDIUM, L. f. Mant. 182; Roxb. Fl. Ind. II. 83 and Corom. Pl. I. t. 12; Wight Icon. t. 558?; Bedd. Fl. Sylv. t. 166; Hf. Ind. Fl II. 31. (*S. cuneifolia*, Roxb. Fl. Ind. II. 86).

HAB. Chittagong; said to grow also in Burmah, possibly in Ava.—Fl. HS.; Fr. CS.

3. S. PANDURATUS, (*S. cuneifolius*, Kurz in Pegu Rep. A. 42, *non* Roxb.).

HAB. Frequent in the upper mixed forests of the Pegu Yomah and Martaban, up to 2000 ft. elevation; also Chittagong.—Fr. CS.

I formerly identified this species with Roxburgh's *S. cuneifolia*, but Hooker reduces this to *S. Anacardium*, and, I think, correctly so, as it is a Hindustani tree.

4. S. HETEROPHYLLUS, Bl. Mus. Bot. I. 187; Miq. Fl. Ind. Bat. I/2. 625.

HAB. Rare in the beach-forests of the Andamans (common on the Nicobars).—Fr. Febr. March.

I (like Hooker) identified flowering male specimens of *Holigarna albicans* with this, but *S. heterophyllus* has flowers more than twice the size and very stout panicles.

5. S. SUBPANDURIFORMIS, Wall. Cat. 987; Fl. Ind. Fl. II. 35. (*S. acuminatus*, Wall. ap. Voigt. Cat. Suburb. Calc. 171; Kurz in Journ. As. Soc. Beng. 1870, 75, *non* Thwait.).

HAB. Frequent in the upper mixed forests of the lower sandstone hills of Arracan; also Chittagong.—Fr. Octob.

6. S. SUBRACEMOSUS, Kurz in Journ. As. Soc. Beng. 1872, 304; Hf. Ind. Fl. II. 35. (*S. microcarpus*, Wall. Cat. 989? ; Hf. Ind. Fl. l. c. 31?).

HAB. Prome District (Col. Eyre).

Anacardium, Roxb.

1. A. OCCIDENTALE, L. sp. pl. 548; Roxb. Fl. Ind. II. 312; Griff. Not. Dicot. 408, t. 565, fig. e. f.; Bedd. Fl. Sylv. t. 163; Hf. Ind. Fl. II. 20.

HAB. In the beach-forests of Chittagong, Tenasserim, and the Andamans; often cultivated in villages.—Fl. Decb.

Gluta, L.

Conspectus of Species.

Leaves coriaceous, the petiole not above 6 lin. long, stout and marginate; panicles and calyx puberulous, ... *G. Tavoyana.*

Leaves chartaceous, the petiole long and slender, not or only at the apex marginate; panicles and flowers perfectly glabrous, ... *G. elegans.*

1. G. TAVOYANA, Hf. Ind. Fl. II. 22 (*Syndesmis Tavoyana*, Wall. Cat. 1004; *G. Renghas*, Kurz in Pegu Rep. A. 41.)

HAB. Tenasserim, from Tavoy southwards.

I fear nothing but a variety of Linné's *G. Renghas*.

2. G. ELEGANS, Kurz in Pegu Rep. A. 41; Hf. Ind. Fl. II. 22 (*Syndesmis elegans*, Wall. in Roxb. Fl. Ind. II. 315). var. HELFERI, Hf. l. c.

HAB. Tenasserim. (Helf. 1118. 1117.)

As pointed out by Hooker, more probably a distinct species, but the material at hand is unsatisfactory.

G. longipetiolata, Kurz in Pegu Rep. l. c. is a tree, common on the shores of the Andamans, with large green long-petioled leaves unlike those of any other species. Flowers and fruits unknown.

Buchanania, Roxb.

Conspectus of Species.

* *Leaves and panicles tomentose or pubescent.*

O Leaves tomentose or pubescent on both sides, large.

Panicles stout and stiff; flowers 2 lin. across, sessile and crowded,........*B. latifolia.*

Panicles slender, grey pubescent; flowers barely a line in diameter, pedicelled and lax, ..*B. laxiflora.*

O O Leaves small, puberulous beneath, glossy above, retuse, the petiole 1—2 lin. long.,....................................*B. Siamensis.*

* * *Leaves glabrous and more or less glossy, usually fuscescent in drying; panicles glabrous or puberulous.*

× Panicles rusty puberulous.

Petiole $\frac{1}{2}$ in. long; flowers a line across; flowers very shortly pedicelled, crowded, ..*B. glabra.*

× × Panicles etc. quite glabrous; flowers pedicelled.

Leaves equally decurrent at the base; pedicels very slender; petals a line long, reflexed; panicles longer than the leaves, ...*B. arborescens.*

Leaves equally decurrent at the base; pedicels short and stout; petals 2—3 lin. long, erect; panicles as long or longer than the leaves,................*B. acuminata.*

Leaves very unequally decurrent at the base, large; pedicels very slender; petals a line long, reflexed; panicles crowded, shorter than the leaves,......*B. lancifolia.*

1. B. LATIFOLIA, Roxb. Fl. Ind. II. 385; Bedd. Fl. Sylv. t. 165; Hf. Ind. Fl. II. 23.

HAB. Common in the open and dry forests, especially the eng-forests, all over Burma, from Ava and Martaban down to Tenasserim.—Fl. March; Fr. Apr.

2. B. LAXIFLORA, Kurz in Journ. As. Soc. Beng. 1872, 304; Hf. Ind. Fl. II. 24.

HAB. Martaban hills, along limestone rocks along the Beeling river (Dr. Brandis); Pegu, above Rangoon (Cleghorn).—Fl. Jan. Febr.

Habit of the preceding species.

3. B. GLABRA, Wall. Cat. 984; Hf. Ind. Fl. II. 23.

HAB. Upper-Tenasserim, Moulmein (Wall.), *teste* Hf.

4. B. ARBORESCENS, Bl. Mus. Bot. I. 183; Miq. Fl. Ind. Bat. I/2. 636 (*Coniogeton arborescens*, Bl. Bydr. 1156; *B. petiolaris*, Miq. l. c. 637; *B. lucida*, Bl. Mus. Bot. I. 184; Hf. Ind. Fl. II. 23; Miq. in Ann. Mus. Lugd. Bat. IV. 117; *B. subobovata*, Griff. Not. IV. 413; *B. Bancana*, Miq. Suppl. Fl. Sum. 205 and 523).

HAB. Tenasserim (*teste* Hf.).

5. B. ACUMINATA, Turcz. in Bull. Mosc. 1858. 472.; Hf. Ind. Fl. II. 24 excl. syn. Bl. (*Sorindeia acuminata*, Wall. in Voigt. Cat. Hort. Calc. 150).

HAB. In the moister forests of the Andaman islands (a large-leaved form); Upper Tenasserim, Moulmein (Lobb.) *teste* Hf.

6. B. LANCIFOLIA, Roxb. Fl. Ind. II. 386; Hf. Ind. Fl. II. 24.

HAB. Chittagong; Arracan (Dr. Schlich); Tenasserim (Helf. 1115, a bad specimen).—Fl. CS.

7. B. SIAMENSIS, Miq. in Ann. Mus. Lugd. Bat. IV. 118.

HAB. Adjoining Siamese province of Radbooree (Teysmann).—Fr. Apr. May.

Bouea, Meisn.

Conspectus of Species.

Panicles small, sessile or nearly so, quite glabrous; petals $\frac{1}{2}$ lin. long; drupes orange or orange-yellow, ... *B. oppositifolia.*

Panicles large, long-peduncled, puberulous; petals a line long or longer; drupes bluish black, ... *B. Burmanica.*

1. B. OPPOSITIFOLIA, Meisn. MS. ap. Walp. Rep. I. 556; Miq. Fl. Ind. Bat. I/2. 635 (*Mangifera oppositifolia*, Roxb. Fl. Ind. I. 640).

HAB. Not uncommon in the tropical forests of Martaban down to Tenasserim and the Andamans; also much cultivated in villages.—Fl. Jan. Febr.; Fr. Apr. May.

2. B. BURMANICA, Griff. in Journ. As. Soc. Beng. 1854. 634 (*B. Brandisiana*, Kurz in Journ. As. Soc. Beng. 1871. 50 and 1873. 66.)

HAB. Upper Tenasserim, Thounggyeen (Dr. Brandis).—Fl. March.

Mangifera, L.

Conspectus of Species.

* *Petals and stamens free, the former inserted at the base of the cushion-like or cupular disk.*

× Panicles and calyx more or less puberulous or pubescent, rarely almost glabrous. Fertile stamen 1.

Panicles and the 3—6 lin. long pedicels very slender, glabrescent or almost glabrous; petals linear-subulate; the lateral nerves very thin, ... *M. longipes.*

Panicles stout; pedicels short and thick; petals yellow, streaked red, hardly 2 lin. long; disk fleshy, 5-lobed; drupes obtuse, 3—4 in. long; net-venation lax and thin, ... *M. Indica.*

Panicles stout; petals hardly 2 lin. long; disk 5-lobed; drupes 1—2 in. long, blunt; net-venation minute and strongly prominent on both sides, ... *M. caloneura.*

× × Panicles and calyx perfectly glabrous.

Panicles stout; pedicels 3—4 lin. long, thick; petals white, about 3 lin. long; disk cup-shaped; drupes acuminate, ... *M. sylvatica.*

* * *Petals and stamens connate with the base of the stalk-like torus, rarely the latter wanting altogether.*

Leaves very coriaceous and shining, almost polished beneath; flesh of drupe soapy, .. *M. fœtida.*

1. M. LONGIPES, Griff. Not. Dicot. 419; Hf. Ind. Fl. II. 15.

HAB. Frequent in the swamp forests and around jungle-swamps of the Irrawaddi alluvium; also Tenasserim.—Fl. CS.

2. M. INDICA, L. sp. pl. 290; Roxb. Fl. Ind. I. 641; Bot. Mag. t. 4510; Hf. Ind. Fl. II. 13.

HAB. Not unfrequent in the tropical and lower mixed forests, from Arracan and Pegu down to Tenasserim and the Andamans; generally cultivated in several varieties in all villages.—Fl. Febr., March; Fr. May to July.

3. M. CALONEURA, Kurz in Journ. As. Soc. Beng. 1873, 66; Hf. Ind. Fl. II. 14.

HAB. Frequent in the low and lower mixed forests of the eastern and southern slopes of the Pegu Yomah.—Fl. Decb. Jan.; Fr. May.

4. M. SILVATICA, Roxb. Fl. Ind. I. 644; Hf. Ind. Fl. II. 15.

HAB. Rare in the tropical forests of the Martaban hills.

Most of the wild mangoes I collected in Burmah having been taken from saplings only, I cannot say whether they belong to this or to the preceding species. The species is frequent in the Sikkim Himalaya and the Khasi hills.

5. M. FŒTIDA, Lour. Fl. Coch. 199; Roxb. Fl. Ind. ed. Wall. II. 440; Griff. Not. Dicot. 419; Hf. Ind. Fl. II. 18.

HAB. Cultivated in South Tenasserim (*teste* Rev. Mason).

N. B. No. 2020 and 2021 referred at Kew (not by me) to *Mangifera* (Ind. Fl. II. 20) are both referable to *Swintonia Schwenckii*.

Spondias, L.

1. S. MANGIFERA, Willd. sp. pl. II. 751; Roxb. Fl. Ind. II. 451; Wight Ill. t. 76; Bedd. Fl. Sylv. t. 169; Hf. Ind. Fl. II. 42. (*S. pinnata,* Kurz in Pegu Rep. A. 44).

HAB. Frequent in the mixed forests, especially the upper ones, all over Burmah, from Chittagong, Prome, and Martaban down to Tenasserim, up to 3000 ft. elevation; also Ava.—Fl. March, Apr.; Fr. CS.

There are two varieties of this, the one with large leaflets and drupes as big as a duck's egg, the other with these parts only half the size, but differing in no other respects.

Doubtful Species.

S.? macrophylla, Wall. Cat. 8480; Hf. Ind. Fl. II. 43.

HAB. Ava, Taong-tong (*teste* Hf.)

Dracontomelum, Bl.

1. D. MANGIFERUM, Bl. Mus. Bot. I. 231. t. 42; Hf. Ind. Fl. II. 43.—(*D. sylvestre,* Bl. Mus. Bot. I. 231; Kurz in Pegu Rep. A. 44; *D. puberulum,* Miq. Suppl. Fl. Sum. 524).

HAB. Frequent in the tropical forests of the Andamans.—Fr. Apr. May.

CONNARACEÆ.

Conspectus of Genera.

Trib. I. CONNAREÆ. Calyx imbricate. Seeds without albumen.

Rourea. Sepals enlarged in fruit, imbricately-cupular. Follicle sessile. Seeds arillate.

Roureopsis. Sepals enlarging, more or less spreading in fruit; follicle sessile.

Connarus. Sepals not enlarging or deciduous. Follicle stalked. Seeds arillate.

Trib. II. CNESTIDEÆ. Calyx valvate, 5-parted. Seeds with or without albumen.

× Seeds with albumen.

Cnestis. Carpels 5—7, sessile, pilose or hispid within. Leaves unpaired pinnate.

× × Seeds without albumen.

Tæniochlæna. Sepals reflexed in fruit. Carpels 5, sessile, glabrous within. Leaves unpaired pinnate.

Ellipanthus. Sepals erect. Carpels solitary, tomentose or velvety within. Leaves 1-foliolate.

Rourea, Aubl.

Conspectus of Species.

* *All parts quite glabrous. Leaflets in few (not above 6) pairs, acuminate.*

Leaflets $1\frac{1}{2}$—2 in. long, the rachis and petiolules very slender, ... *R. pulchella.*

Leaflets 5—3 in. long, the rachis and petiolules stout, ... *R. commutata.*

* * *Inflorescence, leaf-rachis, and often the leaflets beneath puberulous or shortly pilose. Leaflets in numerous pairs, small, usually retuse or rounded.*

× Sepals erect and cupular-closing.

Leaflets pubescent or pilose beneath, ... *R. villosa.*

Leaflets glabrous on both sides, ... *R. Wallichiana.*

× × Sepals spreading.

Leaflets obliquely ovate or obovate, 2-lobed at the summit, ... *R. stenopetala.*

1. R. pulchella, Planch. in Linn. XXIII. 419; Miq. Fl. Ind. Bot. I/2. 658; Hf. Ind. Fl. II. 48.

Hab. Tenasserim, Mergui (Griff.).

2. R. commutata, Planch. in Linn. XXIII. 420; Hf. Ind. Fl. II 47 (*Cnestis monadelpha,* Roxb. Fl. Ind. II. 454).

Var. β. plurijuga, leaves not rarely abruptly pinnate, leaflets in 4—6 rarely in 3 pairs.

Hab. Not unfrequent in the tropical forests of Martaban and Tenasserim down to the Andamans; also Chittagong; var. β. Andamans.—Fl. May, June.

3. R. villosa, Planch. in Linn. XXIII. 422; Hf. Ind. Fl. II. 48.

Hab. Apparently frequent in Tenasserim, from Moulmein southwards.—Fr. March.

4. R. Wallichiana, Planch. in Linn. XXIII. 421; Hf. Ind. Fl. II. 49.

Hab. Tenasserim (*teste* Hf.).

Unknown to me. Hooker points out no structural differences from the preceding, of which it seems to be a glabrescent form only.

5. R. STENOPETALA, Hf. Ind. Fl. II. 49. (*Cnestis steriopetala*, Griff. Not. Dicot. 433. t. 611 f. 2).

HAB. Tenasserim, Mergui (Griff.) *teste* Hf.

Unknown to me; the narrow petals and spreading sepals point to *Roureopsis*.

Connarus, L.

Conspectus of Species.

* *Follicles perfectly glabrous and smooth on the walls inside.*

Rachis of leaves and midrib beneath pubescent, or almost glabrous, the nervation thin, much net-veined especially while young, conspicuously bullate-dotted on the areoles; follicles sessile, ½ in. long, ... *C. stictophyllus.*

* * *Follicles more or less pubescent or velvety within.*

× Petioles and leaflets beneath, or the nerves only, pubescent.

Leaflets pubescent on the midrib beneath, nerves very slender, in 5 pairs, follicles tomentose, ... *C. semidecandrus.*

Leaflets finely rusty pubescent beneath, the nerves very indistinct, ... *C. Griffithii.*

× × Leaflets perfectly glabrous. Follicles stalked.

\+ Follicles chartaceous or thin coriaceous, deeply striate.

A large tree; follicles about an in. long or somewhat longer, ... *C. paniculatus.*

Climber; follicles about an in. long or somewhat longer, ... *C. gibbosus.*

Apparently as preceding, but the follicles nearly cylindrical, ... *C. latifolius.*

\+ + Follicles woody.

Leaflets thick coriaceous, large; follicles about 2 in. long, ... *C. grandis.*

1. C. STICTOPHYLLUS, Kurz MS.

HAB. Tenasserim; also adjoining Siamese province of Radbooree (Teysmann).—Fl. HS.

2. C. SEMIDECANDRUS, Jack in Mal. Misc. 2. VII. 39; Hf. Ind. Fl. II. 52.

HAB. Tenasserim, Mergui (Griff.) *teste* Hf. —Fl. HS.

3. C. GRIFFITHII, Hf. Ind. Fl. II. 52.

HAB. Tenasserim, Mergui (Griff.) *teste* Hf.

4. C. PANICULATUS, Roxb. Fl. Ind. III. 139; Hf. Ind. Fl. II. 52?

HAB. Chittagong (Roxb.).

Hooker calls this a climber, while Roxburgh states that it is a large timber-tree.

5. C. GIBBOSUS, Wall. Cat. 8541; Hf. Ind. Fl. II. 52.

HAB. Common along the outskirts of tropical forests, deserted toungyas, along river-banks, etc., all over Burma, from Chittagong, Pegu, and Martaban to Tenasserim, up to 2000 feet elevation.—Fl. Apr. May; Fr. May, June.

6. C. LATIFOLIUS, Wall. Cat. 8537; Hf. Ind. Fl. II. 53.

HAB. Tenasserim, Moulmein and Tavoy (*teste* Hf.).

Unknown to me, and apparently not sharply distinguished from the preceding.

7. C. GRANDIS, Jack in Mal. Misc. II. 7. 40; Planch. in Linn. XXIII. 429; Hf. Ind. Fl. II. 53.

HAB. Tenasserim or Andamans (Helf.) *teste* Hf.

Cnestis, Juss.

Conspectus of Species.

A scandent shrub; sepals a line long; leaflets usually opposite, ... *C. platantha.*

Erect small tree or shrub; sepals 2 lin. long; flowers long-pedicelled; leaflets often alternate, ... *C. ramiflora.*

1. C. PLATANTHA, Griff. Not. Dicot. 434 (*C. foliosa*, Planch. MS. *C. flaminea*, Griff. l. c. 433. t. 608. f. 2).

HAB. Frequent in all forests, especially the tropical and moister upper-mixed ones, all over the Pegu Yomah, and from Martaban down to Tenasserim, up to 3000 feet elevation.—Fl. RS.; Fr. HS.

2. C. RAMIFLORA, Griff. Not. IV. 432 (*Rourea dasyphylla*, Miq. Suppl. Fl. Sum. 528; *C. ignea*, Planch. MS.).

HAB. Rather frequent in the tropical forests of the Andamans.

Ellipanthus, Hf.

Conspectus of Species.

* *Leaves glabrous or nearly so. Follicles glabrous within.*

Leaves and petiole glabrous, the former 4—6 in. long, nerves beneath very slender, .. *E. calophyllus.*

Petiole and midrib beneath puberulous; leaves 2—3 in. long, nerves strong beneath, .. *E. Helferi.*

* * *Leaves pubescent or tomentose beneath. Follicles glabrous within.*

Nerves beneath very slender; follicles $1\frac{1}{2}$—2 in. long, ... *E. tomentosus.*

1. E. CALOPHYLLUS, Kurz in Journ. As. Soc. Beng. 1872, 305; Hf. Ind. Fl. II. 55.

HAB. Frequent in the tropical forests of the Andamans.—Fl. May; Fr. June, July.

2. E. HELFERI, Hf. Ind. Fl. II. 55.

HAB. Tenasserim or Andamans (Helf.).

3. E. TOMENTOSUS, Kurz in Journ. As. Soc. Beng. 1870, 305; Hf. Ind. Fl. II. 56.

HAB. In the tropical forests of the southern slopes of the Pegu Yomah above Rangoon; Tenasserim.—Fl. Jan.; Fr. March, Apr.

LEGUMINOSÆ.

Conspectus of Genera.

Subord. I. **Eu-Leguminosæ.** Flowers more or less irregular, rarely almost regular and in this case the standard-petal slightly larger and

innermost in bud. Petals imbricate in bud. Stamens definite, variously connate or rarely free.

Trib. 1. *PAPILIONACEÆ.* Uppermost petal (standard) outside in bud.

* *Stamens free from the base or slightly connate at the very base only.*

Subtr. 1. *SOPHOREÆ.* Leaves pinnately 1—many-foliolate. Pods indehiscent or dehiscent.

* *Leaves simple.*

Dalhousiea. Bracts, and bractlets large, opposite, persistent. Calyx-teeth very short. Pods compressed.

* * *Leaves pinnate. Bracts and bractlets small, deciduous.*

Sophora. Pods moniliform, terete or winged, usually indehiscent. Arillus none. Leaves without stipulets.

Ormosia. Pods more or less woody, turgid, dehiscent. Arillus none, but the seeds usually bright red-coloured, with a black hilum. Leaves without stipulets.

Arillaria. Pods fleshy-coriaceous, short, dehiscent; arillus crimson, enveloping the whole seeds. Leaves with stipulets.

Subtr. 2. *PODALYRIEÆ.* Leaves simple or digitately compound. Otherwise as in preceding. (Chiefly Australian plants).

* * *Stamens variously united into a tube, or into a slit sheath or into two separate sheaths with the vexillar stamen free or adnate.*

+ Pods jointed, dehiscent or not, very rarely obsoletely or not jointed, in which case the valves are usually marked with transverse veins or lines (in a few genera the pods consist of a single joint).

Subtr. 3. *HEDYSAREÆ.* Characters as above. Leaves often pinnately 3—1-foliolate, rarely pinnate.

* *Stamens united into a single slit sheath, the vexillary* 10*th one free.*

× Ovules solitary. Pods 1-jointed.

Leptodesmia. Pods dehiscent. Flowers in terminal, head-like racemes.

Lespedeza. Pods indehiscent. Flowers clustered or in racemes, usually axillary.

× × Ovules 2 or more. Pods 2- or more-, rarely(by abortion) 1-jointed.

O Pods not jointed, compressed or inflated.

† Pod inflated like that of *Crotolaria.*

Pycnospora. Herbs with pinnately 3-foliolate leaves; flowers in racemes.

† † Pod compressed.

Ougeinia. Pod constricted between the joints. Flowers fascicled from the old wood. Stamens dimorphous, the alternate ones gland-bearing. Trees.

Pseudarthria. Pods flat with straight sutures. Flowers in terminal racemes. Herbs.

O O Pods distinctly jointed.

† Pod-joints in a line, not folded up.

Desmodium. Pod-joints flat or slightly convex, dehiscent or indehiscent. Racemes terminal or axillary and terminal. Leaves 3- rarely 1-foliolate.

Alysicarpus. Pod-joints more or less turgid. Calyx deeply divided and almost glumaceous. Leaves often 1-foliolate.

MECOPUS. Pod 2-jointed, between uncinnate-subulate bracts, the pedicels abruptly deflexed from the tips. Leaves simple.

† † Pod-joints folded one upon the other.

LOUREA. Calyx enlarged in fruit. Flowers in racemes. Leaves 1—3-foliolate.

URARIA. Calyx not changed in fruit. Flowers in racemes. Leaves 3—1-foliolate, or pinnate.

* * *Stamens* 10, *all united into a single tube or into* 2 *separate sheaths of* 5 *each.*

× Stamens all united into a single complete tube. Anthers dimorphous.

ARACHIS. Calyx-tube filiform, the 4 upper-lobes united, the lowermost thin and free. Petals and stamens inserted at the mouth of the calyx-tube. Pod ripening under the soil. Leaves abruptly pinnate.

ZORNIA. Calyx-tube short. Pod 2—6-jointed, muricate. Herbs, the leaves digitately 2—4-foliolate.

× × Stamens united into 2 separate sheaths of 5 each.

\+ Pod twisted within the calyx.

SMITHIA. Calyx 2-parted. Herbs with abruptly pinnate leaves, the rachis ending in a bristle.

\+ + Pod straight.

GEISSASPIS. Calyx deeply 2-lipped, the upper lip entire. Herbs with abruptly pinnate leaves. Pods 1—2-joined, indehiscent.

ÆSCHYNOMENE. Calyx 2-lipped. Herbs, rarely undershrubs, with unpaired-pinnate leaves. Pods many-jointed.

ORMOCARPUM. Calyx 5-toothed. Pod-joints longitudinally striate or ribbed. Shrubs with unpaired-pinnate leaves.

\+ + Pods not jointed, very rarely 1-seeded.

Subtr. 4. *VICIEÆ.* Petiole terminating in a bristle or tendril. Leaves abruptly pinnate.

* *Stamens* 10, *united into a single slit sheath with the tenth vexillary one free.*

× Leaflets toothed. Wings free from the staminal tube.

CICER. Wings free. Style not bearded at the apex. Pod inflated. Funicle filiform. Erect herbs.

× × Leaflets entire. Wings more or less adhering to the staminal tube.

VICIA. Staminal tube oblique at the mouth. Style pubescent, or bearded at the apex. Ovules usually numerous. Erect or twining herbs.

LENS. Staminal tube oblique at the mouth. Style filiform. Ovules usually 2. Erect herbs.

LATHYRUS. Staminal tube truncate at the mouth. Style flat, or dilated at the apex. Pods more or less compressed. Erect herbs.

PISUM. As preceding but style triquetrous and dilated upwards. Pods turgid.

* * *Stamens only* 9, *all united into a single slit sheath.*

ABRUS. Style not bearded. Pods compressed, chambered within. Climbing undershrubs.

Subtr. 5. *PHASEOLEÆ.* Petiole without tendril. Leaves usually pinnately 3-foliolate, very rarely unpaired pinnate.

* *Leaflets not resinous-dotted beneath.*

× Stamens united into a slit sheath with the 10th vexillary one free (or rarely shortly adnate.)

\+ Nodes of the inflorescence not tumid. Stipules and bracts conspicuous, persistent.

CLITORIA. Petals very unequal in length, the standard narrowed at the base, nude at the apex. Calyx-tube cylindrical, longer than the lobes. Erect or climbing herbs or undershrubs.

SHUTERIA. Style filiform. Calyx-teeth distinct, the 2 upper ones connate. Anthers conform. Bracts persistent, striate.

DUMASIA. Style dilated at the middle. Calyx-tube cylindrical, obliquely truncate at the mouth.

+ + Nodes of the inflorescence tumid.

† Stigma terminal, capitate. Style beardless.

O Anthers all conform.

§ Twining or creeping herbs. Petals equally long.

GALACTIA. Calyx 4-toothed (the 2 upper teeth being united into one). Pod 2-valved.

GRONA. Calyx 5-toothed, the 2 upper teeth free. Pod linear, 2-valved. Seeds strophiolate.

§ § Trees or woody climbers or shrubs.

BUTEA. Petals equally long. The 2 upper calyx-teeth free. Pod indehiscent, 1-seeded at the apex, the sterile basal part much dilated and flat.

ERYTHRINA. Petals very unequal, the standard exceeding the keel.

O O Anthers dimorphous.

MUCUNA. Petals very unequal, the keel exceeding the standard. Woody climbers or twining undershrubs.

† † Style bearded.

O Stigma oblique.

§ Free part of filaments straight, alternately shorter. Twining herbs.

PACHYRRHIZUS. Keel not spirally twisted. Style flat upwards, the stigma almost globose on the inner face. Pod transversely lined between the seeds.

VIGNA. Keel not spirally twisted, blunt or arcuate-beaked. Style filiform.

§ § Free part of filaments once or rarely twice spirally twisted.

PHASEOLUS. Keel spiral. Style filiform. The 2 upper calyx-teeth, or all, shorter than the tube. Hilum oblong or shortly orbicular. Twining or rarely almost erect herbs.

O O Stigma terminal. Free part of filaments straight.

DOLICHOS. Keel not spirally twisted. Style filiform, minutely penicillate around the minute stigma. Twining or rarely suberect herbs.

LABLAB. As preceding, but style thickened upwards, bearded down the inner. edge. Twining or suberect herbs.

× × Stamens all united into a complete tube.

+ Nodes of inflorescence tumid.

CANAVALIA. Upper-lip of calyx projecting. Style beardless or rarely bearded. Pod indehiscent or late-dehiscing, the upper suture thickened or narrowly 2-winged.

PSOPHOCARPUS. Pod 4-cornered, longitudinally 4-winged. Stigma almost globose, densely penicellate-villous.

DIOCLEA. Upper teeth of calyx not projecting. Pod oblong, turgid, indehiscent, the upper suture thickened or 2-winged. Anthers dimorphous.

PUERARIA. Upper teeth of calyx not projecting. Pod linear, flattish, readily dehiscing, many-seeded.

+ + Nodes of inflorescence not tumid. Stipules and bracts minute, deciduous.

TERAMNUS. Calyx-teeth free. Alternate anthers abortive.

GLYCINE. Calyx-teeth free, the 2 upper ones more or less connate. Anthers all fertile and conform.

* * *Leaflets more or less conspicuously resinose-dotted beneath.*

+ Ovules 3 or more.

DUNBARIA. Pods plain or slightly turgid, often falcate, not depressed between the obsoletely strophioled seeds.

ATYLOSIA. Pod transversely depressed or lined between the seeds. Arillus rather large, grooved.

CAJANUS. Pod transversely depressed between the seeds. Arillus or strophiole none.

+ + Ovules 1 or 2.

× Funicle arising from the centre of the hilum.

CYLISTA. Calyx accrescent and leafy, scarious-membranous, the lowermost lobe largest.

RHYNCHOSIA. Calyx not accrescent in fruit. Pods compressed. Leaves pinnately 3-foliolate.

FLEMINGIA. Calyx not accrescent in fruit. Pod turgid. Leaves digitately 3-foliolate.

× × Funicle arising from the extremity of the linear hilum.

ERIOSEMA. Pod transversely depressed. Erect herbs with axillary flowers. Leaves (in Ind. sp.) simple.

Subtrib. 6. *GENISTEÆ.* Stamens usually monadelphous, the filaments not dilated upwards; anthers usually alternately longer and basifix or nearly so, the others smaller and versatile. Leaves digitate. Pod often inflated.

* *Anthers dimorphous. Keel-petals firmly cohering.*

CROTALARIA. Keel beaked. Pod turgid or inflated. Flowers in terminal or leaf-opposite racemes. Herbs or undershrubs with simple or digitately 3—7-foliolate leaves.

PRIOTROPIS. As preceding, but pods much compressed. Leaves digitately 3-foliolate.

* * *Anthers uniform. Keel-petal hardly cohering.*

ROTHIA. Anthers small. Pods follicle-like dehiscing. Herbs.

Subtrib. 7. *LOTEÆ.* Stamens usually diadelphous (9 + 1), the filaments dilated upwards. Leaves digitately or pinnately compound.

* *Leaflets quite entire* (Loteæ).

LOTUS. Petals adnate to the staminal tube. Keel beaked. Pod 2-valved. Leaves pinnately 5-foliolate.

PAROCHETUS. Petals deciduous, free from the staminal tube, the keel rather acute. Pod 2-valved. Flowers solitary or in poor umbels. Leaves digitately 3-foliolate.

* * *Veins of leaflets usually produced into marginal toothlets. Leaves pinnately 3-foliolate. Keel-petal blunt.*

× Pod spirally falcate or circinate.

MEDICAGO.

× × Pod straight or nearly so.

TRIGONELLA. Pod elongate, straight, erect or recurved, indehiscent or dehiscing along one or both sutures.

MELILOTUS. Pod small, rotundate or oblong, more or less indehiscent.

Subtrib. 8. *GALEGEÆ.* Stamens 10, variously connate, the filaments filiform upwards; anthers usually versatile. Pods dehiscent or indehiscent. Leaves unpaired pinnate, rarely simple.

* *Pods dehiscent (very rarely indehiscent and in this case small and 1-seeded)* (Eu-Galegeæ).

× Pods distinctly transversely chambered within, dehiscent, or 1-seeded and indehiscent.

† Pods 1-seeded and indehiscent. Hairs basifix.

*PSORALEA. Anthers blunt. Leaves simple or 3-foliolate, the leaflets gland-dotted. Seed adhering to the pericarp.

† † Pods several-seeded and dehiscent.

O Anthers apiculate. Hairs fixed by the centre.

CYAMOPSIS. Stamens monadelphously united into a tube. Leaflets entire or toothed.

INDIGOFERA. Stamens diadelphous (9 + 1). Leaves pinnately many—1-foliolate.

O O Anthers blunt. Hairs basifix.

SESBANIA. Style not bearded, the stigma minute. Flowers in axillary racemes. Leaves pinnate. Herbs or undershrubs, rarely trees.

× × Pods not chambered within, many-seeded.

TEPHROSIA. Vexillary stamen only at the middle adnate to the staminal tube, free at the base. Pods thin coriaceous. Herbs, undershrubs or rarely shrubs. Leaves pinnately many—1-foliolate.

MILLETTIA. Filaments diadelphous (9 + 1), filiform. Pod woody or coriaceous. Trees or woody climbers. Leaves pinnate.

* * *Pods indehiscent, usually many or several-seeded.* (Dalbergieæ).

× Pods wingless.

PONGAMIA. Filaments usually long. Pod more or less flattish, firmly fleshy coriaceous. Trees. Leaflets opposite.

DREPANOCARPUS. Filaments alternately shorter. Pods reniform or crescent-shaped, coriaceous or drupaceous, 1—3-seeded. Trees or woody climbers. Fl. white or purple. Leaflets alternate.

× × Pods winged along the one or both sutures.

DALBERGIA. Filaments alternately shorter. Pods oblong to linear, all round extended into a chartaceous or coriaceous wing. Trees or woody climbers. Flowers from white to rose and purple. Leaflets alternate.

PTEROCARPUS. Filaments equally long. Pods almost orbicular or broadly oblong, seed-bearing in the centre and surrounded by a broad complete wing. Trees. Flowers yellow. Leaflets alternate.

DERRIS. Filaments alternately shorter. Pod flat, thin or coriaceous, winged along one or both sutures. Trees or woody climbers. Leaflets opposite.

Trib. 2. *CÆSALPINIEÆ.* Of the imbricate or valvate petals the uppermost one (standard) innermost in bud. Stamens free or connate.

* *Anthers erect and basifix, rarely almost versatile, usually opening by* 2 *apical pores, rarely opening in longitudinal slits.*

Subtrib. 1. *CASSIEÆ.* Leaves unpairedly or abruptly pinnate. Sepals free to the disk, usually imbricate. Ovary or ovary-stalk free.

* *Petals all developed.*

CASSIA. Sepals imbricate. Stamens 5—10. Leaves abruptly pinnate. Trees, shrubs or herbs.

* * *Petals none, or* 1—2 *and minute.*

DIALIUM. Stamens 2; anthers 2-rimose. Sepals imbricate. Pod turgid or globose. Leaves unpaired pinnate. Trees.

* * *Anthers versatile, opening by longitudinal slits.*

Subtrib. 2. *BAUHINIEÆ.* Leaves simple, 2-foliolate or simply pinnate. Calyx gamosepalous, or the sepals free to the disk, imbricate or valvate. Ovary-stalk adnate to the calyx-tube or rarely free.

* *Leaves simple and more or less 2-lobed, or 2-foliolate.* (Eu-Bauhineæ).

BAUHINIA. Petals unequal. Calyx gamosepalous or valvate. Pods dehiscent. Leaves palmately 5—many-nerved.

* * *Leaves abruptly pinnate.* (Amherstieæ).

× Calyx-tube short, the disk basal or nearly so. *(Cynometreæ.)*

\+ Petals none.

HARDWICKIA. Sepals 5, much imbricate. Stamens 10, all perfect or 1—3 reduced to staminodes. Pod flat-compressed, 2-valved at the apex. Leaflets in 1 to several pairs.

\+ + Petals 5 or fewer.

CYNOMETRA. Sepals 4—5. Petals 5, imbricate. Stamens 10 or many. Pod fleshy, indehiscent or tardily dehiscing. Leaflets in 1 to many pairs.

× × Disk at the top of a prolonged calyx-tube. *(Eu-Amherstieæ).*

\+ Petal 1—5. Trees.

O Calyx-tube rather short. Petal 1.

SINDORA. Calyx valvate or nearly so, often echinate. Petal sessile. Stamens shortly monadelphous, 2 of them perfect, the rest castrate or reduced to filaments. Leaflets in 2—3 pairs. Seeds arillate. Pods woody, echinate.

O O Calyx-tube elongate.

† Petal one.

PAHUDIA. Calyx-segments 4, much imbricated. Petal shortly clawed. Stamens 10, 7 of them high-up connate, the rest entirely reduced or 2 of them represented by minute staminodes. Leaflets in 2 or more pairs. Seeds arillate. Pods firmly woody, smooth.

AFZELIA. Calyx-segments 4, much imbricated. Petal clawed. Stamens 3—8, free, with or without a few minute staminodes. Pod large, woody or coriaceous. Seeds not arillate. Leaves abruptly pinnate.

† † Petals 3—5.

TAMARINDUS. Petals 3, with the rudiments of 2 others. Staminodes teeth-like. Stamens monadelphous, only 3 of them developed. Pod turgid, indehiscent, the acid mesocarp pulpy.

AMHERSTIA. Petals 5, 3 of them nearly equally long, and like the lowermost one, very broad, the 2 others minute or rudimentary. Stamens diadelphous (9 + 1).

\+ + Petals none.

SARACA. Sepals 4. Stamens 3—9. Pods coriaceous, 2-valved. Trees.

Subtrib. 3. *EUCÆSALPINIEÆ.* Leaves usually abruptly bipinnate. Sepals free to the disk, valvate or imbricate. Ovary or ovary-stalk free.

× Sepals valvate or nearly so. Trees.

POINCIANA. Pod 2-valved, flat, coriaceous. Leaves bipinnate, the leaflets all developed. Unarmed.

PARKINSONIA. Pod turgid-moniliform, indehiscent. Petiole very short, spine-like, with 2—4 much elongate pinnæ of minute and often quite reduced leaflets. Armed.

× × Sepals imbricate. Trees or woody climbers.

+ Climbers, usually armed.

CÆSALPINIA. Pods not winged, indehiscent or 2-valved, several-seeded. Stigma small.

PTEROLOBIUM. Pods samaroid, indehiscent, the upper end produced into a conspicuous wing-like appendage, 1-seeded. Ovary 1-ovuled.

MEZONEURON. Pod flat, several-seeded, indehiscent, the upper suture extended into a wing. Stigma small.

+ + Erect trees, not armed.

PELTOPHORUM. Pods flat, several-seeded, indehiscent, both sutures extended into a wing. Stigma peltate. Stamens 10, free.

ACROCARPUS. Pods as in preceding, but indehiscent and winged along the upper suture only. Stigma minute. Petals narrow, almost equal. Stamens 5, free.

Subord. II. Mimoseæ. Flowers regular, the petals valvate in bud, free or more usually united into a shorter or longer tube. Stamens definite or indefinite, free or connate.

Trib. 1. *MIMOSEÆ.* Stamens definite, usually 10 or 5, or twice as many as the petals.

Subtrib. 1. *MIMOSEÆ VERÆ.* Anthers gland-tipped or not. Stamens free. Calyx valvate in bud.

* *Anthers gland-tipped.*

× Flowers in spikes or racemes.

ADENANTHERA. Pods 2-valved, often falcate or circinate, transversely chambered between the seeds. Flowers in spikes or racemes. Erect trees. Leaves bipinnate.

ENTADA. Pods large, the indehiscent joints separating from the persistent thickened sutures. Flowers in spikes. Tendril-bearing woody climbers. Leaves bipinnate.

× × Flowers in oblong or globose heads.

NEPTUNIA. Pods flat, 2-valved, thin coriaceous. Flowers in dense heads. Erect herbs. Leaves bipinnate.

* * *Anthers not gland-tipped.*

× Pods more or less jointed, the joints receding from the persistent sutures.

MIMOSA. Flowers in dense spikes or heads. Shrubs or herbs, with bipinnate leaves.

× × Pods continuous, not jointed.

+ Valves of pod chartaceous or thin coriaceous.

DESMANTHUS. Pod flat, narrow, 2-valved. Stigma clavate. Herbs with bipinnate leaves. Flowers in heads.

LEUCÆNA. Pods flat, rather broad, 2-valved. Stigma capitate. Shrubs or small trees with bipinnate leaves. Flowers in globose heads.

+ + Valves of pod thick and woody, falcate.

Xylia. Pods woody, tardily dehiscing. Flowers in globose heads. Trees with bipinnate leaves.

Subtrib. 2. *PARKIEÆ.* Calyx imbricate in bud. Stamens monadelphous.

Parkia. Stamens 10, in neuters reduced to long filaments. Flowers in large long-peduncled heads, the lower ones neuter, the upper ones fertile. Trees with bipinnate leaves.

Trib. 2. *ACACIEÆ.* Stamens indefinite, free or connate.

Subtrib. 3. *ACACIEÆ VERÆ.* Stamens free.

Acacia. Pods various, dehiscent or not. Flowers in heads or dense spikes. Trees or shrubs, sometimes climbing, with bipinnate leaves or the leaves reduced to phyllodia, armed or unarmed.

Subtrib. 4. *INGEÆ.* Stamens connate. Flowers in heads or dense spikes.

* *Seeds without an arillus, but on longer or shorter funicles.*

Albizzia. Pods straight. Trees with bipinnate leaves.

Pithecolobium. Pods more or less circinnate or cochleate. Trees or shrubs, rarely climbing, with bipinnate leaves.

Calliandra. Pods more or less falcate, with much thickened sutures. Trees or shrubs, with bipinnate leaves.

* * *Seeds conspicuously arillate.*

Inga. Pods variously circinnate or cochleate. Trees or shrubs with simply pinnate leaves.

Arillaria, Kurz.

1. A. robusta, Kurz in Journ. As. Soc. Beng. 1873, 71. (*Sophora robusta*, Roxb. Hort. Bengh. 31.; Wight Icon. t. 245).

Hab. Not unfrequent in the tropical forests of the southern slopes of the Pegu Yomah (above and about Rangoon) and in Upper Tenasserim.—Fl. Apr. June.

Sophora, L.

1. S. tomentosa, L. sp. pl. 533; Roxb. Fl. Ind. II. 316; Miq. Fl. Ind. I. 124; Bth. in Mart. Fl. Bras. Papil. 314, t. 124. (*S. occidentalis*, L. l. c.; Bot. Mag. t. 3390).

Hab. Not unfrequent in the beach-forests of the Andamans; also Pegu (Brandis).

Lespedeza, Mich.

Conspectus of Species.

* *Flowers in axillary almost sessile clusters.*

Appressed silvery silk-hairy; leaflets linear-cuneate, ... *L. sericea.*

* * *Flowers in axillary and terminal racemes often collected into terminal panicles.*

× All parts densely and softly pubescent; bracts deciduous.

Softly tomentose; racemes robust and sessile; calyx-teeth almost filiform and flexuose, ... *L. pinetorum.*

× × Branchlets and underside of leaves appressedly greyish puberulous.

Racemes glandular-pubescent; bracts persistent, ... *L. decora.*

Racemes tawny pubescent, not glandular; bracts deciduous, ... *L. parviflora.*

1. L. SERICEA, Miq. Ann. Mus. Lugd. Bat. III. 49; Maxim. Syn. Lesped. 42; Hf. Ind. Fl. II. 142 (*Hedysarum sericeum*, Thbg. Fl. Japon. 289; *L. cuneata*, Don. Gen. Syst. II. 307; *Hedysarum junceum*, Roxb. Fl. Ind. Bat. III. 362, non L. f.).

HAB. Ava, Khakyen hills, east of Bhamo (J. Anderson).—Fl. May.

2. L. PINETORUM, Kurz in Journ. As. Soc. Beng. 1873, 230 and l. c. 1874. 184 sub. 13.

HAB. Not unfrequent in the drier hill-forests of Martaban, at 4000 to 6000 ft. elevation.—Fl. Fr. March.

Allied to *L. tomentosa*, Sieb.

3. L. DECORA, Kurz in Journ. As. Soc. Beng. 1873, 231; Hf. Ind. Fl. II. 144.

HAB. Frequent in the drier, especially the pine-forests of Martaban, at 4000 to 6000 ft. elevation.—Fl. March; Fr. Apr.

Allied to *L. eriocarpa*, DC.

4. L PARVIFLORA, Kurz in Journ. As. Soc. Beng. 1873, 231; Hf. Ind. Fl. II. 144.

HAB. Martaban hills (Nattoung), east of Tounghoo (Revd. F. Mason).

Allied to *L. elliptica*, Bth., from which it differs by its much smaller flowers, its subulate calyx-teeth, the different vestiture of its inflorescence, and its deciduous bracts.

Pycnospora, R. Br.

1. P. HEDYSAROIDES, RBr. in WA. Prod. I. 197; Bth. Fl. Hongk. 91; Hf. Ind. Fl. II. 153. (*P. nervosa*, WA. Prod. I. 197).

HAB. Tenasserim (Helf. 1813).

Pseudarthria, WA.

1. P. VISCIDA, WA. Prod. I. 209; Wight Icon. t. 286; Hf. Ind. Fl. II. 154. (*Hedysarum viscidum*, L. Syst. III. 506; Roxb. Fl. Ind. III. 356; *Desmodium viscidum*, DC. Prod. II. 316).

HAB. Upper Tenasserim (Falconer, Griff.).

Desmodium, Desv.

Conspectus of Species.

A. DEHISCENTIA. Pod-joints dehiscing along the ventral suture.

Subg. 1. *Pleurolobium*, DC. Pod-joints dehiscing along the more or less indented suture, distinctly separated or continuous and the separation indicated by a transverse line only. Inflorescence in a young state conspicuously imbricate-bracted.

* *All bracts deciduous. Pods continuous, the joints marked only by transverse lines. Erect shrubs or herbs.*

Shrub, the leaflets one-coloured; flowers purple; pod-joints about $2\frac{1}{2}$ lin. long by 3 broad, densely and shortly hirsute, ... *D. gyroides.*

Annual or biennial, the leaves as often 1- as 3-foliolate, with the 2 lateral leaflets much reduced, leaflets white-variegated; flowers pale yellow, turning pale brick-coloured; pod-joints about $2\frac{1}{2}$ lin. long and broad, shortly and sparingly hirsute, .. *D. gyrans.*

* * *Lowermost bracts of young inflorescences more or less persistent. Pods distinctly jointed.*

Leaves 3-foliolate, the leaflets elliptical to oblong; fruiting pedicels erect; racemes elongate, ... *D. heterocarpum.*

Leaves 1—3-foliolate, the leaflets more or less orbicular; fruiting pedicels refracted; racemes shorter than the leaves, ... *D. retroflexum.*

Subg. 2. *Sagotia*, Walp. Pod-joints dehiscing along the lower more or less indented suture. Young inflorescence not conspicuously bracted.

* *Flowers in many-flowered terminal and axillary racemes which often form terminal panicles. Erect annual herbs.*

Stems and underside of leaves sparingly and appressedly greyish pubescent; panicle glandular-puberulous; pods glabrescent, ... *D. oblongum.*

Stems and peduncles spreadingly tawny pilose; pods tawny pilose, ... *D. auricans.*

* * *Flowers few, axillary or in leaf-opposed racemes. Prostrate or diffuse herbs.*

Flowers in leaf-opposed and spuriously terminal simple or branched racemes; leaflets very small, ... *D. microphyllum.*

Flowers usually yellowish, by 1—4 on a longer or shorter axillary peduncle which is longer than the leaves, ... *D. reptans.*

Flowers usually purple or rose-coloured, by 1—6 in the leaf-axils, ... *D. triflorum.*

B. Indehiscentia. Pod-joints not dehiscing in any way.

* *Flowers in terminal and axillary racemes often collected into panicles. Bracts small, deciduous or rarely persistent.*

Subg. 3. *Eu-desmodium*, DC. Shrubs, undershrubs or herbs, the leaves 1—3-foliolate; petiole not winged. Pods various, many-jointed, the joints variously shaped, but never quite square.

* *Pods and ovary quite glabrous, the joints more or less deeply indented on the lower suture, the basal one very shortly stalked.*

× Leaves simple, broader than long, oblate to reniform.

Flowers 3 lin. long, sky-blue, on capillary glandular pedicels $\frac{1}{3}$—$\frac{1}{2}$ in. long; pod-joints deeply indented at the lower suture, ... *D. oblatum.*

Flowers small, white, on pedicels $1\frac{1}{2}$—2 lin. long; pod-joints slightly indented at the lower suture, ... *D. reniforme.*

× × Leaves oblong to oblong-lanceolate.

Leaves simple, or the lower ones 3-foliolate; racemes slender, in diffuse terminal panicles; pod-joints elliptical, 2 lin. long by $1\frac{1}{2}$ broad, ... *D. substipulaceum.*

* * *Pods and ovary variously clothed with glandular or glandless, straight or hooked hairs.*

× Pod-joints 4—5 times longer than broad, or if shorter stalk-like narrowed at the base.

\+ Pod-joints pedicel-like narrowed or abruptly constricted at the base, securiform or crescent-shaped, puberulous.

O Pod-joints crescent-shaped, abruptly constricted at both ends.

Leaves oblong, acute or blunt, strongly parallel-nerved; pod-joints broadly lunate, tumid and only 2 lin. long, coriaceous, the basal one refracted on a stalk 2 lin. long thickened club-like at the apex, ... *D. concinnum.*

Leaves divaricately obcordate; pod-joints membranous, broadly lunate, acute and divaricate at both ends, very flat; spreading or trailing herb, ... *D. obcordatum.*

O O Pod-joints securiform, the basal one long-stalked.

Calyx about a line, the corolla 5 lines long; stalk of basal pod-joint about 1—½ lin. long, ... *D. scalpe.*

Calyx and corolla half the size; stalk of basal pod-joint slender, ½ in. long, .. *D. podocarpum.*

+ + Pod-joints truncate at both ends, oblong to linear-oblong and sessile.

O Leaves pinnately 3-foliolate.

Pod-joints only 1½—2 lin. long by ½—¾ lin. broad, densely hooked puberulous, not narrowed at the ends, ... *D. recurvatum.*

O O Leaves simple, the petiole short.

Pod-joints 6—8, ⅔ in. long, slightly narrowed at both ends, irregularly striate, shortly glandular-pubescent; petioles longer or shorter, ... *D. ormocarpoides.*

Very near the preceding, the petiole very short; pod-joints 10—12, about 3 lin. long and hardly a line broad, shortly glandular-pubescent, ... *D. teres.*

× × Pod-joints narrow, as long or only twice as long as broad.

+ Shrubs or more usually erect or spreading perennials. Pod-joints usually as long as broad, more or less rotundate with truncate ends.

O Leaves simple. Pod-joints indented at the lower suture, about a line long.

Perennial, erect, slightly appressed-pubescent; racemes elongate and very slender; pod-joints sparingly and shortly hispid; leaves acute, ... *D. Gangeticum.*

As preceding, but diffuse, the leaflets broader and usually blunt, ... *D. flexuosum.*

Shrub, densely pubescent; racemes tomentose, rather short and robust; pod-joints densely and shortly grey hirsute; leaves blunt, ... *D. latifolium.*

O O Leaves 3-foliolate. Pod-joints about a line long and broad.

Erect shrubby perennial; leaflets somewhat repand, glaucescent beneath, acute or acuminate; branchlets almost terete; pod-joints densely covered with hooked stiff hairs, ... *D. sequax.*

Diffuse perennial, the branches sharply 5—6-angular; leaflets entire, blunt; pod-joints sparingly covered with white hooked stiff hairs, ... *D. diffusum.*

+ + Shrubs or woody undershrubs. Pod-joints usually about twice as long as broad, more or less indented on one or both sutures.

O Bracts of the young inflorescence scarious and large, forming imbricate cones, very deciduous, but the basal ones usually remaining persistent.

† Basal pod-joint sessile.

Racemes sessile or peduncled, rather short; pod-joints 1½—2 lin. long and nearly as broad, indented on the lower suture, appressed hirsute; branchlets sharply angular, often villous on the corners, ... *D. floribundum.*

† † Basal pod-joint shortly but distinctly stalked.

Racemes slender, long-peduncled, forming spreading terminal panicles; pod-joints ⅓ in. long and 3 lin. broad, puberulous, slightly indented; branchlets terete or nearly so, ... *D. tiliæfolium.*

Racemes very slender and usually shorter than the leaves, sessile or branched from the base; pod-joints 4 lin. long by $2\frac{1}{4}$ broad, more or less indented at the lower suture, sparingly and shortly hirsute; branches angular, ...*D. karensium.*

Racemes sessile or nearly so, robust, usually axillary or panicled by the fall of the leaves; pod-joints 4 lin. long by $2\frac{1}{2}$ broad, grey-villous, much indented at the lower suture; branchlets rather terete, ...*D. confertum.*

O O Bracts of the young inflorescence narrow, herbaceous, not conspicuous and imbricating (*Catenaria*, Bth.).

Flowers $\frac{1}{3}$ in. long, often in axillary slender racemes; pod-joints oblong, nearly 4 lin. long, densely and shortly hooked-hairy, the basal one stalked,....*D. laburnifolium.*

Subgen. 4. *Pteroloma*, Desv. Shrubs. Leaves 1-foliolate, the petiole winged. Bracts minute. Pods very flat, many-jointed, the joints not or hardly indented and almost square.

Branchlets sharply triquetrous; pods glabrous or pubescent along the sutures or all over, ...*D. triquetrum.*

* * *Flowers clustered or in sessile or peduncled umbels in the axils of the leaves or in the axils of bract-like floral leaves.*

Subgen. 5. *Dendrolobium*, WA. Flowers in dense sessile or peduncled axillary umbels or clusters. Bracts minute or deciduous. Leaves pinnately 3-foliolate. Pods 5—1-jointed, appressed pubescent.

* *Pods normally* 2—1-*jointed. Undershrubs.* (Dicerma).

Flowers by 2—4 or fewer clustered in the leaf-axils and passing into terminal leafy racemes, ...*D. biarticulatum.*

* * *Pods* 2—5-(*only occasionally* 1-) *jointed. Shrubs or trees* (Dendrolobium proper).

Flowers in sessile clusters; pod-joints only 2 lin. long,..................*D. cephalotes.*

Flowers in peduncled umbels; pod-joints about 4 lin. long,.............*D. umbellatum.*

Subgen. 6. *Phyllodium*, Desv. Flowers clustered or umbellate, in the axils of bract-like large floral leaves which are complicately 2-foliolate, persistent, and placed distichously. Leaves pinnately 3- or rarely 1-foliolate. Pods 2—4-jointed.

* *Pods pubescent or villous-pubescent.*

Leaflets 3—5 in. long, acuminate; pods villously pubescent, ...*D. grande.*

Leaflets 1—2 in. long, rounded or almost retuse,.........................*D. vestitum.*

* * *Pods glabrous except on the margin.*

Leaves pinnately 3- or occasionally 1-foliolate, the petiole only 2—3 lin. long; pods glabrous, net-veined, ...*D. pulchellum.*

1. D. GYROIDES, DC. Prod. II. 326; Hf. Ind. Fl. II. 475 (*D. pseudo-gyroides*, Miq. Fl. Ind. Bat. I. 244).

HAB. Frequent in the mixed forests, especially the upper ones, chiefly in the stony bed of streams, all over Burma, from Arracan, Pegu, and Martaban down to Tenasserim.—Fl. Close of RS.; Fr. CS.

2. D. GYRANS, DC. Prod. II. 336; Wight Icon. t. 294; Hf. Ind. Fl. II. 174 (*Hedysarum gyrans*, Lamk. Suppl. 332; Jacq. Icon. rar. t. 562; Roxb. Fl. Ind. III. 317).

HAB. Common in all leaf-shedding forests, but more especially in the savannahs, in grassland and amongst shrubbery of the plains, ascending into the drier hill-forests and hill-pastures up to 4000 ft. elevation, all over Burmah, from Chittagong and Ava down to Tenasserim.—Fl. Fr. CS.

3. D. HETEROCARPUM, DC. Prod. II. 337 (*Hedysarum heterocarpum*, L. sp. pl. 1054; Burm. Fl. Zeyl. 117, t. 53, f. 1.; *D. polycarpum*, DC. l. c. 334; Wight Icon. t. 406; Bak. in Fl. trop. Afr. II. 165; Hf. Ind. Fl. II. 171; *Hedysarum purpureum*, Roxb. Fl. Ind. III. 358; *D. patens*, Wight Icon. t. 407; *Hedysarum patens*, Roxb. Fl. Ind. III. 362).

Var. *α*. GENUINUM, branches and leaves beneath only thinly appressed-pubescent; pods glabrous with fringed edges, or sparingly and minutely stiff-hairy.

Var. *β*. TRICHOCAULON, Bak. in Hf. Ind. Fl. II. 172 (*D. trichocaulon*, DC. Prod. II. 336; Hassk. Pl. Jav. rar. 367; Bth. Fl. Austr. II. 235), branches densely and spreadingly pilose, the leaves beneath appressed pilose; the rest as in var. *α*.

Var. *γ*. CAPITATUM, (*D. capitatum*, DC. Prod. II. 225; Miq. Fl. Ind. Bat. I. 241; Hf. Ind. Fl. II. 170; *Hedysarum capitatum*, Burm. Fl. 167, t. 54, f. 1), branches and leaves beneath more or less silvery pubescent, the leaflets smaller; pods puberulous.

HAB. Var. *α*. common in all leaf-shedding forests, especially the mixed ones, entering also the savannahs and cultivated lands, all over Burma and the adjacent islands; var. *β*. Ava hills; var. *γ*. Arracan.—Fl. Close of RS. ~~; Fr. CS.~~

4. D. RETROFLEXUM, DC. Prod. II. 336; Hf. Ind. Fl. II. 170. (*Hedysarum retroflexum*, Linn. Mant. 103).

HAB. Tenasserim (Helf. 1692).

5. D. OBLONGUM, Wall. Cat. 5714; Bth. Pl. Jungh. I. 224 in adn.

HAB. Rather frequent in the upper mixed forests of the Pegu Yomah; Ava, Taong Dong (Wall.).—Fl. Nov.; Fr. CS.

This agrees so far with Hasskarl's description of *D. Aparines* (Miq. Fl. Ind. Bat. I. 252), but I have no specimens to compare with.

6. D. AURICANS, Grah. in Wall. Cat. 5704; Bth. in Pl. Jungh. I. 223 in adn.; Kurz in Journ. As. Soc. Beng. 1873, 23; Hf. Ind. Fl. II. 172.

HAB. Frequent amongst shrubbery in sandy grounds in the neighbourhood of the sea in Arracan; Tenasserim, Tavoy (Wall.).—Fl. Close of RS.; Fr. CS.

7. D. MICROPHYLLUM, DC. Prod. II. 336; Miq. Fl. Ind. Bat. I. 239. (*Hedysarum microphyllum*, Thbg. Fl. Japan. 284; *D. parvifolium*, DC. l. c. 334; Hf. Ind. Fl. II. 174).

HAB. Martaban, Yoonzeleen, at 2500 ft. elevation (Brandis); Ava (*teste* Baker).—Fl. Fr. March.

8. D. REPTANS (*Hedysarum reptans*, Burm. Fl. Zeyl. t. 54. f. 1; Roxb. Fl. Ind. III. 354; *D. heterophyllum*, DC. Prod. II. 334; Hf. Ind. Fl. II. 173; *D. triflorum* var. WA. Prod. I. 229; Wight Icon. t. 291; *Hedysarum heterophyllum*, Willd. sp. pl. III. 1201).

Hab. More in woody lands and amongst shrubbery of Pegu and Tenasserim.—Fl. Fr. RS.

9. D. triflorum, DC. Prod. II. 334; Wight Icon. t. 292; Bth. in Mart. Fl. Bras. XV. 95. t. 26; Hf. Ind. Fl. II. 173. (*Hedysarum triflorum*, L. sp. pl. 1057; Roxb. Fl. Ind. III. 353; *Hedysarum stipulaceum*, Burm. Fl. Ind. t. 54. f. 2.).

Hab. Frequent in short-grassed pastures and in cultivated lands, rubbishy places, along river-banks, &c., all over Burma, from Chittagong and Ava down to Tenasserim; on the Andamans introduced only.—Fl. Fr. RS. chiefly.

10. D. oblatum, Bak. in Journ. As. Soc. Beng. 1873, 230; Hf. Ind. Fl. II. 166.

Hab. Not unfrequent in the tropical forests, especially along rocky choungs, of the Pegu Yomah and the Martaban hills; also Prome hills; Ava, on Taong-Dong.—Fl. Fr. C. and HS.

11. D. reniforme, DC. Prod. II. 327; Hf. Ind. Fl. 173. (*Hedysarum reniforme*, L. sp. pl. 1051; Burm. Fl. Ind. t. 52. f. 1.).

Hab. Prome; Ava, on the banks of the Irrawaddi (according to Baker).

All Burmese specimens seen by me belong to the preceding species. I myself gathered the true Burmannian plant only in the Terai-lands of Sikkim.

12. D. substipulaceum, Bl. MS. (*D. stipulaceum*, Miq. Fl. Ind. Bat. I. 252, non. DC.; *Hedysarum mucronatum*, Bl. Buitenz. Cat. 92).

Hab. Martaban, Nattoung Hills. (Revd. F. Mason).

This species greatly resembles the American *D. stipulaceum*, DC. (which I suppose to be the same as *D. cajanifolium*, DC., referred to by Baker in Fl. Ind. II. 161). It differs in its stouter stature and its broad ovate (not linear-subulate) calyx-lobes. The pod-joints are glabrous and net-veined, not hooked-pilose like those of Hasskarl's *D. Aparines*, which Miquel combines with *D. stipulaceum*, while Baker would make it synonymous with *D. spirale*.

13. D. concinnum, DC. Prod. II. 335; Miq. Fl. Ind. Bat. I. 245; Hf. Ind. Fl. II. 170. (*D. pendulum*, Wall. Pl. As. rar. I. t. 94.).

Hab. Not unfrequent in grass-lands of the drier hill-forests (especially the pine-forests) of Martaban, at 4000 to 6000 ft. elevation.—Fr. March.

14. D. obcordatum, Kurz in Journ. As. Soc. Beng. 1873, 229; Hf. Ind. Fl. II. 166. (*Uraria obcordata*, Miq. Suppl. Fl. Sumatr. 114 and 305).

Hab. Tenasserim, Moulmein District (Falconer).—Fr. Febr.

15. D. Scalpe, DC. Prod. II. 334; Bak. in Fl. trop. Afr. II. 164; Hf. Ind. Fl. II. 165. (*D. strangulatum*, WA. Prod. I. 228; Wight Icon. t. 985).

HAB. In the moister hill-forests of Martaban, east of Tounghoo, at 4000 to 5000 ft. elevation.

Baker identifies the *D. trichocaulon* of Hasskarl's Pl. Jav. rar. 367 with the above, but this he could only do by simply guessing, for the description does not in the least agree and the dehiscent pods at once indicate its true affinity.

16. D. PODOCARPUM, DC. Prod. II. 336; Hf. Ind. Fl. II. 165.

HAB. Ava Hills.

N. B. If *D. laxum*, DC. l. c. (*Hedysarum laxum*, Spreng. Syst. app. 292) is correctly referred to the above species (as to which I entertain grave doubts), this name has precedence.

17. D. RECURVATUM, Grah. in Wall. Cat. 5717; WA. Prod. 226; Wight Icon. t. 374; Miq. Fl. Ind. Bat. I. 250. (*Hedysarum recurvatum*, Roxb. Hort. Bengh. 57. and Fl. Ind. III. 358; Wight Icon. t. 409; *Hedysarum diffusum*, Roxb. Fl. Ind. III. 357, non Willd; *D. laxiflorum*, DC. Prod. II. 335; Hf. Ind. Fl. II. 164; *D. diffusum*, DC. l. c. 335, not 336).

HAB. Common in the dry and upper mixed forests of Chittagong, Arracan, and Pegu.—Fl. Close of RS.; Fr. CS.

18. D. TERES, Wall. Cat. 5694; Bth. in Pl. Jungh. I. 225 in adn.; Hf. Ind. Fl. II. 164.

HAB. Ava, Taong Dong (Wall.).

19. D. GANGETICUM, DC. Prod. II. 327; Wight Icon. t. 271; Hf. Ind. Fl. II. 168. (*Hedysarum Gangeticum*, L. sp. pl. 1052; Roxb. Fl. Ind. III. 349; *Hedysarum collinum*, Roxb. Fl. Ind. III. 348; *D. latifolium*, Wight Icon. t. 272).

HAB. Frequent in all deciduous forests, especially the mixed ones, also entering the savannahs and cultivated lands, all over Burma, from Chittagong and Ava down to Tenasserim.—Fl. RS.; Fr. CS.

20. D. FLEXUOSUM, Wall. Cat. 5691; Bth. in Pl. Jungh. 224, in adn.; Hf. Ind. Fl. II. 168.

HAB. Prome Hills.

This, as already suggested by Bentham, is hardly more than a diffuse variety of *D. Gangeticum*, with broader leaves and spreadingly hirsute branches.

21. D. LATIFOLIUM, DC. Prodr. II. 328; Wight Icon. t. 370; Hf. Ind. Fl. II. 168. (*Hedysarum latifolium*, Roxb. Hort. Beng. 57 and Fl. Ind. III. 350; Bot. Reg. t. 355; *D. lasiocarpum*, DC. Prod. II. 328; Bak. in Fl. trop. Afr. II. 162).

HAB. Frequent in the dry and open forests of Ava, Prome, Pegu, and Martaban.—Fl. Close of RS.; Fr. CS.

22. D. SEQUAX, Wall. Pl. As. rar. II. t. 157; Hf. Ind. Fl. II. 170.

(*D. sinuatum*, Bl. MS. ap. Miq. Fl. Ind. Bat. I. 255; Hf. Ind. Fl. II. 166; *D. dasylobum*, Miq. Suppl. Fl. Sum. 113 and 305).

HAB. In the drier hill-forests of Martaban, east of Toungthoo, at 4000 to 5000 ft. elevation.

23. D. DIFFUSUM, DC. Prod. II. 336; Wight Icon. t. 298; Hf. Ind. Fl. II. 169. (*Hedysarum diffusum*, Willd. Sp. pl. III. 1180; *Hedysarum auriculatum*, and *H. quinqueangulatum*, Roxb. Fl. Ind. III. 355; *D. quinquangulare*, Wight Icon. t. 293).

HAB. Prome Hills (Wall. Cat. 5716, D.).—Fl. Sept.—Octob.

24. D. FLORIBUNDUM, Don. Gen. Syst. II. 297; Hf. Ind. Fl. II. 167. (*Hedysarum floribundum*, Don. Prod. Nep. 244; *D. multiflorum*, DC. Prod. II. 335; *D. dubium*, Ldl. Bot. Reg. t. 967; Bot. Mag. t. 2960).

HAB. Not unfrequent in the drier hill-forests of Martaban and Upper Tenasserim, at 4000 to 5000 ft. elevation.—Fl. Close of RS.; Fr. March.

25. D. TILIÆFOLIUM, Don. Gen. Syst. II. 297; Hf. Ind. Fl. II. 168.

HAB. Tenasserim, Tavoy (according to Baker).

26. D. KARENSIUM, Kurz, MS.

HAB. Martaban, rare in the pine-forests east of Toungthoo, at 4000 to 5000 ft. elevation; Ava, Khakyen Hills east of Bhamo.—Fr. March.

27. D. LABURNIFOLIUM, DC. Prod. II. 337; Hf. Ind. Fl. II. 163. (*Hedysarum laburnifolium*, Poir. Dict. VI. 422; *Catenaria laburnifolia* Bth. in Pl. Jungh. I. 220).

HAB. Ava Hills.

28. D. TRIQUETRUM, DC. Prod. II. 326; Hf. Ind. Fl. II. 163. (*Hedysarum triquetrum*, L. sp. pl. 1050; Roxb. Fl. Ind. III. 347; *Pteroloma triquetrum*, Bth. in Pl. Jungh. I. 220).

VAR. *α*. GENUINUM, pods more or less greyish hirsute or villous, larger and usually somewhat curved; flowers larger.

VAR. *β*. PSEUDO-TRIQUETRUM, (*D. pseudo-triquetrum* and *D. alatum*, DC. Prod. II. 326; *Hedysarum alatum*, Roxb. Fl. Ind. III. 348), pods glabrous or pubescent only on the edges, shorter and straight; flowers smaller.

HAB. Common in all leaf-shedding forests, especially the mixed ones, but also ascending into the drier hill-forests up to 5000 ft. elevation; all over Burma, from Chittagong and Ava down to Tenasserim and the Andamans; var. *β*. equally common, but restricted to low levels.—Fl. Fr. Close of RS., and CS.

29. D. BIARTICULATUM, F. Muell. Fragm. Phyt. II. 121; Bth. Fl. Austr. II. 231; Hf. Ind. Fl. II. 163. (*Dicerma biarticulatum*, DC. Prod. II. 339; Wight Icon. t. 419; *Hedysarum biarticulatum*, L. sp. pl. 1054; Roxb. Fl. Ind. III. 359).

HAB. Ava, Irrawaddi valley at Mengoon (J. Anderson) and Paghamyo (Wall.).—Fr. Jan.

30. D. CEPHALOTES, Wall. Cat. 5721; Wight Icon. t. 373; Bedd. Fl. Sylv. 87. Anal. t. 12. f. 4; Hf. Ind. Fl. II. 162. (*Dendrolobium cephalotes*, Bth. Pl. Jungh. I. 218; *Hedysarum cephalotes*, Roxb. Fl. Ind. III. 360; *Hedysarum umbellatum*, Roxb. l. c.; *D. congestum*, Wall. Cat. 5723; Wight Icon. t. 209).

HAB. Common in the mixed forests, especially the lower ones, entering also the savannahs; all over Chittagong and Ava, down to Pegu and Arracan.—Fl. Close of RS.; Fr. CS.

31. D. UMBELLATUM, DC. Prod. II. 325; Bth. Fl. Austr. II. 230; Hf. Ind. Fl. II. 161. (*Dendrolobium umbellatum*, WA. Prod. I. 224; *Hedysarum umbellatum*, L. sp. pl. 1053).

HAB. Frequent in the beach-forests all along the coasts of the Andamans and Tenasserim; re-appears on the limestone hills of Segain, Ava.—Fl. Fr. CS.

32. D. GRANDE, Kurz in Journ. As. Soc. Beng. 1874, 184; Hf. Ind. Fl. II. 162.

HAB. Ava, Irrawaddi valley near Tagoung (J. Anderson).—Fl. RS.

33. D. VESTITUM, Bth. MS.; Hf. Ind. Fl. II. 162. (*Phyllodium vestitum*, Bth. in Pl. Jungh. I. 217).

HAB. Tenasserim, from Moulmein down to Mergui.—Fr. CS.

34. D. PULCHELLUM, Bth. in Hongk. Fl. 83; Hf. Ind. Fl. II. 162. (*Dicerma pulchellum*, DC. Prod. II. 339; Wight Icon. t. 418; *Hedysarum pulchellum*, Roxb. Fl. Ind. III. 361).

HAB. Frequent in all deciduous but chiefly in the open and dry forests, all over Burma, from Chittagong and Ava down to Tenasserim; also Andamans.—Fl. RS.; Fr. CS.

Alysicarpus, Neck.

Conspectus of Species.

* *Calyx shorter than the first pod-joint.*

Pod-joints inflated-globular, without wrinkles or veins, ... *A. monilifer.*

Pod-joints slightly compressed, thickened at the truncate ends, obsoletely wrinkled-net-veined, ... *A. vaginalis.*

* * *Calyx much longer than the first pod-joint, the teeth much imbricate in fruit.*

Calyx-lobes lanceolate, acuminate; pods as long or twice as long as the calyx, the joints (fully ripe) almost smooth, obliquely 4-angular, ... *A. bupleurifolius.*

Glabrous; calyx-lobes broader and acute; pod enclosed in the scarious calyx, the joints broader than long, strongly and transversely wrinkled, ... *A. rugosus.*

As preceding, but stems silk-hairy, the calyx-lobes and bracts fringed with long silky hairs; pod-joints twice the size, ... *A. styracifolius.*

1. A. MONILIFER, DC. Prod. II. 353; Hf. Ind. Fl. II. 157. (*Hedysarum moniliferum*, L. Mant. 102; Burm. Fl. Ind. t. 52, f. 3; Roxb. Fl. Ind. III. 345).

HAB. Ava; Tenasserim, near Moulmein (Wall.).

2. A. VAGINALIS, DC. Prod. II. 353; Hf. Ind. Fl. II. 158. (*Hedysarum vaginale*, L. sp. pl. 1051; Roxb. Fl. Ind. III. 345).

Var. α. GENUINA, leaves all, or only the cauline ones, narrow.

Var. β. NUMMULARIFOLIUS, Miq. Fl. Ind. Bat. I. 232; Hf. Ind. Fl. II. 158. (*Alysicarpus nummularifolius*, DC. Prod. II. 353; *Hedysarum nummularifolium*, L. sp. pl. 1051), leaves all more or less oval or almost orbicular, usually small and sometimes very small or minute.

HAB. Frequent in grassy places of all leaf-shedding forests and in cultivated lands, all over Chittagong, Pegu, and Martaban, down to Tenasserim; var. β. more in the drier forests, in sandy pastures, etc.—Fl. Close of RS.; Fr. CS.

3. A. BUPLEURIFOLIUS, DC. Prod. II. 352; Hf. Ind. Fl. II. 158. (*Hedysarum bupleurifolium*, L. sp. pl. 1081, non Roxb.; *Hedysarum gramineum*, Retz. Obs. v. 26; Roxb. Fl. Ind. III. 646).

HAB. Frequent in long-grassed jungle-pastures of the dry and open (especially the low) forests, from Ava and Prome down to Pegu.—Fl. RS.; Fr. CS.

4. A. RUGOSUS, DC. Prod. II. 353; Bth. Fl. Austr. II. 239; Hf. Ind. Fl. II. 159. (*Hedysarum rugosus*, Willd. sp. pl. III. 1173; *Hedysarum bupleurifolium*, Roxb. Fl. Ind. III. 646, non L.; *A. Wallichii*, WA. Prod. I. 234).

HAB. Frequent in all leaf-shedding forests, especially in the savannahs and savannah-forests, and in grassy cultivated lands of the alluvial plains of Pegu.—Fl. Close of RS.; Fr. CS.

5. A. STYRACIFOLIUS, DC. Prod. II. 353. (*Hedysarum glumaceum*, Koen. ap. Roxb. Fl. Ind. III. 247; *A. rugosus var. styracifolius*, Bak. in Hf. Ind. Fl. II. 159).

HAB. Ava (according to Baker).

N. B. *Hedysarum procumbens*, Roxb. Fl. Ind. III. 346, is the same as *Alys. hamosus*, Edg., and Roxburgh's name has precedence.

Mecopus, Benn.

1. M. NIDULANS, Benn. in Horsf. Pl. Jav. rar. 154, t. 32; Miq. Fl. Ind. Bat. I. 266; Hf. Ind. Fl. II. 160.

HAB. Very common in the upper mixed forests of the Pegu Yomah, less frequent in similar forests of Martaban and Tenasserim.—Fl. Close of RS.; Fr. CS.

Lourea, Neck.

Conspectus of Species.

* *Glabrous herbs. Calyx glabrous.*

Terminal leaflet several times broader than long, transversely divaricate-lunate, ... *L. vespertilionis.*

Terminal leaflet barely twice as broad as long, obversely reniform, ... *L. paniculata.*

* * *More or less puberulous or pilose herbs. Calyx pubescent or villous.*

Leaflets obversely reniform to oblate; racemes simple, terminal, ... *L. reniformis.*

I. L. PANICULATA, Wall. Cat. 5673; Bth. in Pl. Jungh. I. 215 in adn.; Hf. Fl. II. 154.

HAB. Ava, Taong dong (Wall.).

2. L. RENIFORMIS, DC. Prod. II. 324. (*Hedysarum reniforme,* Lour. Fl. Coch. II. 345; *L. obovata,* Desv. Journ. Bot. III. 122; Hf. Ind. Fl. II. 154).

HAB. Ava, on the limestone hills of Segain and Pagha myo (Wall.).—Fl. Oct.

Uraria, Desv.

Conspectus of Species.

* *Flowers in elongate slender lax racemes, the upper ones collected into terminal panicles.*

× Bracts subulate, persisting at the flowering. Pedicels in fruit straight, but reflexed.

Calyx-lobes $1\frac{1}{2}$ lin. long, long-tawny-pilose; stipules lanceolate, $\frac{1}{2}$ in. long; pods densely hooked-hispid, ... *U. cordifolia.*

× × Bracts very deciduous long before opening of the flowers. Pods minutely puberulous. Pedicels in fruit arcuate.

Pods glossy; calyx about 2 lin. long, in fruit rather ample and almost enclosing the pod, ... *U. campanulata.*

Pods opaque; calyx $1\frac{1}{2}$—2 lin. long, very much shorter than the pod, ... *U. hamosa.*

* * *Flowers in dense thick simple or almost simple racemes.*

× Bracts all very deciduous and fallen long before opening of the flowers.

O Upper leaves pinnately 5—9-foliolate.

† Leaflets narrow.

Leaflets white-variegated, blunt or bluntish, the net-venation beneath strong and close; pod-joints leaden-coloured, polished; seeds pale-coloured, ... *U. picta.*

Leaflets glaucous-green, one-coloured, long and very sharply acuminate, the net-venation very thin and lax; pod-joints glossy; seeds brown, ... *U. acuminata.*

† † Leaflets broad.

Leaflets with prominent and close net-venation; pod-joints opaque, ... *U. crinita.*

O O Leaves 1- and 3-foliolate (often on the same plant).

Rather stout plant, usually tawny pilose; pods opaque, net-veined, ... *U. Lagopus.*

× × Bracts all persistent at flowering time and conspicuous.

Robust, the racemes elongate and brown-pilose; pods glossy black, ... *U. alopecuroides.*

Slender, the racemes short and greyish pilose; pods pale-coloured, opaque, *U. lagopoides.*

1. U. CAMPANULATA, Wall. Cat. 5685; Voigt Hort. Calc. 221. (*Lourea campanulata*, Bth. in Pl. Jungh. I. 215 in adn.; Hf. Ind. Fl. II. 155).

HAB. Ava, Taong Dong (Wall.).—Fl. R. and CS.; Fr. CS.

This species connects *Uraria* and *Lourea*, two genera rather too artificially separated.

2. U. HAMOSA, Wall. Cat. 5681; Wight Icon. t. 284; Hf. Ind. Fl. II. 156. (*Doodia hamosa*, Roxb. Fl. Ind. III. 367; *Desmodium Horsfieldii*, Miq. Fl. Ind. Bat. I. 251; *Desmodium dasyphyllum*, Miq. l. c. 253, *teste* Baker).

HAB. Frequent in all leaf-shedding forests, especially the mixed ones and the eng-forests, entering also the savannahs, from Chittagong and Ava down to Pegu and Arracan.—Fl. Close of RS.; Fr. CS.

Doodia simplicifolia, Roxb. Fl. Ind. III. 366, seems to be only the simple-leaved form of this species, which Wallich distributed under the name of *U. leptostachya*.

3. U. CORDIFOLIA, Wall. Pl. As. rar. I. 33, t. 37; Hf. Ind. Fl. II. 157.

HAB. Not unfrequent in the dry forests of Ava and Prome, occasionally seen in the drier upper mixed forests of the Pegu Yomah.—Fl. Fr. Close of RS.

4. U. PICTA, Desv. Journ. d. Bot. III. 122; Wight Icon. t. 411; Hf. Ind. Fl. II. 155 (*Hedysarum pictum*, Jacq. Icon. rar. III. t. 567; *Doodia picta*, Roxb. Fl. Ind. III. 368).

HAB. Not rare along river-banks and in grass-lands of Chittagong and Arracan; also Ava.—Fl. Fr. RS.

5. U. ACUMINATA, Kurz MS.

HAB. Not unfrequent in the eng-forests of Pegu and Martaban.—Fl. CS.

Very near to the preceding, but it has altogether a different look and differs in the characters given above.

6. U. CRINITA, Desv. Journ. d. Bot. III. 122; Hf. Ind. Fl. II 155 excl. syn. Icon. Wight. (*Hedysarum crinitum*, L. Mant. 102; Burm. Fl. Ind. 169. t. 56; *Doodia crinita*, Roxb. Fl. Ind. III. 369).

Var. *β*. MACROSTACHYA, Wall. Pl. As. rar. II. 8. t. 110; more robust, the leaves larger; racemes 1—1½ feet long.

HAB. Frequent in the mixed forests all over Burma, from Chittagong, Ava, Pegu, and Martaban down to Tenasserim.—Fl. Close of RS; Fr. CS.

7. U. LAGOPUS, DC. Prod. II. 324; Hf. Ind. Fl. II. 156 (excl. syn. Wight and Roxb.) (*U. lagopoides*, Royle Ill. Him. Pl. 201 t. 33. f. 1.).

HAB. Chittagong.—Fl. Close of RS.

8. U. ALOPECUROIDES, Wight Icon. t. 290. (*Doodia alopecuroides*,

Roxb. Fl. Ind. III. 368 ; *U. repanda,* Wall. Cat. 5677 ; Bth. in Pl. Jungh. I. 269 ; Hf. Ind. Fl. II. 156).

HAB. Along the banks of the Irrawaddi in Prome and Ava.—Fl. RS.

9. U. LAGOPOIDES, DC. Prod. II. 324 ; Wight Icon. t. 289 ; Hf. Ind. Fl. II. 156 (*Hedysarum lagopoides,* L. sp. pl. 1057 ; Burm. Fl. Ind. 68. t. 53. f. 2. ; *Doodia lagopodioides,* Roxb. Fl. Ind. III. 366).

HAB. Chittagong ; most probably in other parts of Burma.—Fl. RS.

Zornia, Gmel.

1. Z. DIPHYLLA, Pers. Syn. II. 318 ; Bth. Fl. Austr. II. 228 and in Mart. Fl. Bras. XV. 80. t. 21-22 ; Hf. Ind. Fl. II. 147 (*Hedysarum diphyllum,* L. sp. pl. 560 ; Roxb. Fl. Ind. III. 353.)

HAB. Not unfrequent on sandy or gravelly pastures and in grassy places of the eng and dry forests, all over Arracan, Pegu, and Prome ; also Ava.—Fl. Fr. RS.

Arachis, L.

*1. A. HYPOGÆA, L. sp. pl. 1040 ; Roxb. Fl. Ind. III. 280 ; WA. Prod. I. 280 ; Miq. Fl. Ind. I. 281.

HAB. Cultivated all over Burma.—Fl. Fr. R. and CS.

Smithia, Ait.

Conspectus of Species.

* *Fruiting calyx simply striate, not reticulate, the lobes more or less acute ; joints of pod more or less globular.*

Calyx-lobes quite glabrous and nude ; flowers in slenderly peduncled naked heads or short racemes.......... *S. sensitiva.*

Calyx-lobes more or less hairy-fringed on the keel beneath ; flowers in dense sessile heads involucred by the uppermost leaves, ... *S. conferta.*

Calyx-lobes minutely toothed, the teeth all excurrent into long stiff bristles ; flowers in dense slenderly peduncled naked heads,.......... *S. ciliata.*

* * *Fruiting calyx urceolate-bell-shaped, striate and net-veined, the lobes more or less truncate ; pod-joints (and also the seeds) much compressed.*

Leaflets in 4 to 2 pairs ; upper part of stipule about 3 lin. long ; pod-joints 10—12, about a line long, papillose,.......... *S. dichotoma.*

Leaflets in 10—15 pairs ; upper part of stipule nearly an in. long ; pod-joints 20—25, 2 lin. long or longer, veined,.......... *S. grandis.*

1. S. SENSITIVA, Ait. Hort. Kew. III. 496 t. 13 ; Roxb. Fl. Ind. III. 342 ; Salisb. Parad. Lond. t. 92 ; Hf. Ind. Fl. II. 148. (*S. Javanica,* Bth. in Pl. Jungh. I. 211 ; Miq. Fl. Ind. Bat. I. 271).

HAB. Very frequent in moist pasture-land, along grassy borders and in fallow fields, especially in diluvial lands, all over Burma, from Chittagong, Pegu, and Martaban down to Tenasserim.—Fl. Fr. RS.

2. S. CONFERTA, Sm. in Rees Cyclop. XXXIII. No. 2; Miq. Fl Ind. Bat. I. 272. (*S. geminiflora*, var. *conferta*, Bak. in Hf. Ind. Fl. II. 149; *S. hispidissima*, Zoll. in Geneesk. Arch. III. 55).

HAB. Tenasserim, Tavoy (Wall. Cat. 5668 I).—Fl. Octob.

3. S. CILIATA, Royle Ill. Him. Pl. 201. t. 35. f. 2; Hf. Ind. Fl. II. 150.

HAB. Not unfrequent in the hill-pastures and in grassy spots of the drier hill-, especially the pine-forests of Martaban, at 3500 to 5000 feet elevation; also largely entering the deserted hill-toungyas.—Fl. Fr. RS.

4. S. DICHOTOMA, Dalz. MS.; Hf. Ind. Fl. II. 150.

HAB. Arracan, in long-grassed pastures on sandstone banks near the sea opposite Akyab.—Fl. Fr. Octob.

5. S. GRANDIS, Bth. MS.; Hf. Ind. Fl. II. 151.

HAB. Pegu, in diluvial lands bordering the southern and western base of the Pegu Yomah, rather rare in temporarily inundated long-grassed jungle-pastures.—Fl. Fr. RS.

Geissaspis, WA.

1. G. CRISTATA, WA. Prod. I. 218; Bedd. Icon. t. 293; Hf. Ind. Fl. II. 141.

HAB. Common in wet pastures, rice-fields, etc., especially of the alluvial plains, all over Arracan, Pegu, and Martaban down to Tenasserim; also Ava.—Fl. RS.; Fr. Close of R. and begin of HS.

Æschynomene, L.

Conspectus of Species.

Calyx and corolla glabrous, the latter only 4 lin. long; pod-joints only 2 lines long, . . *Æ. Indica.*

Calyx and outside of keel of corolla sparingly hairy, the corolla about an in. long; pod-joints about $\frac{1}{3}$ in. long, ... *Æ. aspera.*

1. Æ. INDICA, L. sp. pl. 1061; Wight Icon. t. 405; Hf. Ind. Fl. II. 151. (*Æ. Cachemiriana*, Camb. in Jacq. Voy. 40. t. 48; *Ae. sensitiva*, P. d. B. Fl. d'Owar. 89. t. 53, non Sw.; *Hedysarum Neli-tali*, Roxb. Fl. Ind. III. 365; *Smithia aspera*, Roxb. l. c. 343).

HAB. Frequent in swamps and along swampy river-sides, in wet pastures, etc., all over Burma, from Chittagong and Ava down to Tenasserim.—Fl. Fr. RS.

2. Æ. ASPERA, L. sp. pl. 1060; Wight Icon. t. 299; Hf. Ind. Fl. II. 152. (*Hedysarum lagenarium*, Roxb. Fl. Ind. III. 365; *Æ. trachyloba*, Miq. Fl. Ind. Bat. I. 276).

HAB. Chittagong and Arracan, along borders of tanks and in swampy grass-lands; probably also in Pegu and elsewhere.—Fl. Fr. RS.

Ormocarpum, P. d. B.

1. O. SENNOIDES, DC. Prod. II. 315; Wight Icon. t. 297; Hf. Ind. Fl. II. 152. (*Hedysarum sennoides*, Willd. sp. pl. III. 1207; Roxb. Fl. Ind. III. 364; *O. ochroleucum*, Zoll. and Mor. Syst. Verz. 6.; Miq. Fl. Ind. Bat. I. 1083).

HAB. Siam; most probably also in Tenasserim.

Cicer, L.

*1. C. ARIETINUM, L. sp. pl. 1040; Roxb. Fl. Ind. III. 324; Bot. Mag. t. 2274; Wight Icon. t. 20; Schrank Handb. t. 202; Sibth. Fl. Graec. t. 703; DC. Legum. t. 54; Hf. Ind. Fl. II. 176.

HAB. Generally cultivated in the plains all over Burma.—Fl. Fr. CS.

Vicia, L.

Conspectus of Species.

Flowers solitary, almost sessile, nearly ½ in. long; pods glabrous, 6—18-seeded, .. *V. sativa.*

Flowers hardly 2 in. long, several (2—8) forming a peduncled raceme; pods shortly hairy, 2-seeded, ... *V. hirsute.*

*1. V. SATIVA, L. sp. pl. 1037; Roxb. Fl. and 323, III. t. 522; Engl. Bot. t. 334; Schrank Fl. Monac. III. t. 264; Sturm Deutschl. Fl. VIII. t. 31; Alef. in Bonpl. 1861, 71; Hf. Ind. Fl. II. 178.

HAB. Ava, Bhamo (J. Anderson).—Fl. Febr.

Lens, Gren. and Godr.

*1. L. ESCULENTA, Mœnch Meth. 131; Alef. in Bonpl. 1861, 130. (*Ervum Lens*, L. sp. pl. 1039; Koch Syn. Fl. Germ. 172; WA. Prod. I. 235; Schrank Handb. t. 102; Sturm Deutschl. Fl. VIII. t. 32; *Cicer Lens*, Willd. sp. pl. III. 1114; Roxb. Fl. Ind. III. 324).

HAB. Chittagong, cultivated by natives.—Fl. Fr. CS.

Lathyrus, L.

Conspectus of Species.

Leaves reduced to tendril-like petioles; stipules ¾—1 in. long, sagittately ovate; flowers yellow, ... *L. Aphaca.*

Leaves pinnate, with 1—2 pairs of leaflets; stipules half-sagittate, small; flowers skyblue or white, ... *L. sativus.*

*1. L. SATIVUS, L. sp. pl. 1030; Roxb. Fl. Ind. III. 322; Sibth. Fl. Græc. t. 695; Bot. Mag. t. 115; Koch Syn. Fl. Germ. 174; Hf. Fl. Ind. Fl. II. 179.

HAB. Chittagong, cultivated only.—Fl. Fr. CS.

Pisum, L.

*1. P. SATIVUM, L. sp. pl. 1026; Roxb. Fl. Ind. III. 321; Koch Syn. Fl. Germ. 172; Schrank. Fl. Monac. III. t. 261.

Var. *α.* SATIVUM, flowers larger, white; seeds globular or nearly so, pale coloured or green.

Var. *β.* ARVENSE. (*P. arvense,* L. sp. pl. 1027; Koch. Syn. Fl. Germ. 172; Sturm. Deutschl. Fl. II. t. 4; Sibth. Fl. Græc. t. 687; flowers white or pale violet, the wings and keel purple; seeds somewhat depressed angular, greyish, brown- or purple-mottled.

HAB. Var. *α.* Cultivated in Ava, Prome, Pegu, etc.; var. *β.* cultivated in Chittagong.—Fl. Fr. CS.

Abrus, L.

Conspectus of Species.

Pods $\frac{1}{2}$—$\frac{1}{3}$ as broad as long, somewhat crumpled; seeds terete, ...*A. precatorius.*
Pods flat and straight, 4 to 5 times as long as broad; seeds compressed, ..*A. lævigatus.*

1. A. PRECATORIUS, L. Syst. 533; Roxb. Fl. Ind. III. 257; Bth. Fl. Hongk. 92; Hf. Ind. Fl. II. 175.

HAB. Frequent in the mixed forests, especially the lower and upper ones, but also in hedges, etc., of cultivated lands, all over Burma, from Chittagong and Ava down to Tenasserim.—Fl. Close of RS.; Fr. CS.

2. A. LÆVIGATUS, E. Mey. Comm. Pl. Afr. 263; Harv. Fl. Cap. II. 263.—(*A. pulchellus,* Wall. Cat. 5819; Baker in Fl. trop. Afr. II. 175 and Fl. Ind. II. 875; *A. melanospermus,* Hassk. Cat. Bog. 282; Miq. Fl. Ind. Bat. I. 159).

HAB. Pegu, Rangoon (Cleghorn); Upper Tenasserim, between Chappedong and Amherst (Wall.).—Fl. Close of RS.; Fr. CS.

N. B. Thwaites' *A. pulchellus* differs by its much larger and broader seeds.

Clitoria, L.

Conspectus of Species.

× Corolla quite glabrous.

Leaflets in 2 or rarely in a single pair; bractlets roundish, ... *C. Ternatea.*

× × Standard more or less pilose outside; leaves pinnately 3-foliolate.

Calyx glabrous, the teeth much shorter than the tube; bractlets only 2—3 lin. long, linear, subulate-acuminate; flowers by twos, peduncled, ... *C. Mariana.*
Calyx puberulous, the teeth as long as the tube; bractlets broader and larger, nearly $\frac{1}{2}$ as long as the calyx; flowers by 3—6 clustered in the leaf-axils, ... *C. Grahamii.*

1. C. TERNATEA, L. sp. pl. 1086; Bot. Mag. t. 1542; Roxb. Fl. Ind. III. 321; Hf. Ind. Fl. II. 208.

HAB. Not unfrequent in the mixed forests, more especially the savannah-forests, all over Chittagong and Ava down to Tenasserim; also

in hedges, in shrubbery, along river-sides, etc., of cultivated lands.—Fl. Fr. chiefly RS.

2. C. GRAHAMII, Steud. Nomencl. Bot. 2nd ed.; Bth. in Pl. Jungh. II. 232 in adn.

Var. α. GRAHAMII (*C. Grahamii*, Steud. l. c.) elongate, twining, appressed pubescent; bractlets broader and larger, nearly half as long as the calyx; leaflets acuminate or sharply acuminate; calyx-lobes narrower, subulate-acuminate; pedicels very short, the raceme almost reduced; standard more pilose outside.

Var. β. MACROPHYLLA (*C. macrophylla*, Wall. Cat. 5345; Bth. in Linn. Proc. II. 38; Hf. Ind. Fl. II. 209), more robust in all parts, the shoots and petioles spreadingly tawny pubescent, glabrescent; leaves larger, acute or nearly so; raceme short, often branched; the rest as in preceding.

HAB. Tenasserim (Helf. 1727), Tavoy (Wall. Cat. 5346); Bithoko range, at 3000 ft. elevation (Brandis); var. β. Ava, Taongdong; and Prome hills (Wall.)—Fl. Fr. RS.

Shuteria, WA.

Conspectus of Species.

More or less hairy; racemes sessile, naked; pods hairy, ... *Sh. vestita.*
All parts (also the pods) quite glabrous; racemes filiform, furnished with 1 or 2 distant whorls of broad floral leaves, ... *Sh. suffulta.*

1. S. VESTITA, WA. Prod. I. 207; Wight Icon. t. 165; Hf. Ind. Fl. II. 181.

HAB. Common in grassy places and amongst sunny shrubbery of the drier hill-forests of Ava and Martaban, at 3000 to 5000 ft. elevation, in places descending to 2000 ft.—Fr. HS.

2. S. SUFFULTA, Bth. in Pl. Jungh. I. 232 in adn.; Hf. Ind. Fl. II. 182.

HAB. Frequent in the drier upper mixed and the dry forests, ascending into the drier hill-forest up to 4000 ft. elevation, all over Burma, from Ava and Martaban down to Pegu.—Fl. Close of RS.; Fr. DS.

Dumasia, DC.

Conspectus of Species.

Young parts, ovary, and pods more or less pubescent, ... *D. villosa*
All parts, also the ovary, glabrous, ... *D. leiocarpa.*

1. D. LEIOCARPA, Bth. in Pl. Jungh. I. 231. (*D. villosa* var. *leiocarpa*, Baker in Hf. Ind. Fl. II. 183).

HAB. Not unfrequent in grasslands and amongst shrubbery of the drier hill- (especially the pine-) forests of the Martaban hills, east of Tounghoo, at 4000 to 5000 ft. elevation.—Fr. March.

Differs from the glabrous Ceylon plant chiefly in the smaller leaves, and in the pods, which are not torulose.

Galactia, P. Br.

Conspectus of Species.

All parts scantily and minutely appressed-pubescent; leaves glabrous above, .. *G. tenuiflora.*

All parts, also the upper side of the leaves, softly but shortly pubescent, .. *G. villosa.*

1. G. TENUIFLORA, WA. Prod. I 206; Miq. Fl. Ind. Bat. I. 220; Hf. Ind. Fl. II. 192. (*Glycine tenuiflora*, Willd. sp. pl. III. 1057; Roxb. Fl. Ind. III. 319).

HAB. Ava, Irrawaddi, on the hills opposite the island Loongyi (Wall. Cat. 5520).—Fl. Sept.

2. G. VILLOSA, WA. Prod. I. 207; Miq. Fl. Ind. Bat. I. 220. (*G. tenuiflora* var. 3. *villosa*, Bak. in Hf. Ind. Fl. II. 192).

HAB. Ava, Segain, on the limestone hills.—Fr. Nov.

Grona, Bth., vix Lour.

Conspectus of Species.

Leaves 3-nerved at the base, glabrous above; flowers ½ in. long, in lax racemes, .. *G. Grahamii.*

Leaves palmately 5-nerved, sparingly hirsute on both sides; flowers 2 lin. long, yellow, solitary on filiform axillary peduncles, ... *G. filicaulis.*

1. G. GRAHAMII, Bth. in Pl. Jungh. I. 233; Hf. Ind. Fl. II. 191.

HAB. Prome hills (Wall.).—Fl. Sept., Octob.

2. G. FILICAULIS, Kurz in Journ. As. Soc. Beng. 1873, 232; Hf. Ind. Fl. II. 191.

HAB. Frequent in the low and the savannah-forests of the Irrawaddi plains of Pegu.—Fl. Close of RS.; Fr. CS.

Butea, Roxb.

(*Meizotropis*, Voigt Cat. Hort. Calc. 239; *Megalotropis*, Griff. Not. Dicot. 441.)

Conspectus of Species.

Subg. 1. *Butea*, Roxb. Corolla very large, orange-scarlet, appressed silk-hairy outside, the keel and standard more or less acute.

× Pods stalked.

Tree; pedicels ½—1 in. long, ... *B. frondosa.*

Woody climber; pedicels 1—1½ in. long, ... *B. superba.*

× × Pods sessile.

Erect shrub; corolla only an inch long, ... *B. minor.*

Subg. 2. *Spatholobus*, Hassk. Corolla small, white or purple, glabrous keel and standard more or less blunt. Woody climbers.

Leaves large, beneath appressed silvery pubescent; pods stalked; flowers white, .. *B. parviflora.*

Leaves small, glabrous to the naked eye; pods sessile; flowers white, ... *B. acuminata.*

1. B. FRONDOSA, Roxb. Corom. Pl. I. t. 21 and Fl. Ind. III. 244; Hook. Bot. Misc. III. 102, and Wight Ill. Ind. Bot. Suppl. 57. t. 32; Bedd. Fl. Sylv. t. 176; Hf. Ind. Fl. II. 194.

HAB. Frequent in the lower mixed and the dry forests, more especially however in the savannah-forests and entering even the tidal savannahs; all over Burmah, from Ava and Martaban down to Tenasserim.—Fl. March, Apr.; Fr. Apr., May.

2. B. SUPERBA, Roxb. Corom. Pl. I. t. 22. and Fl. Ind. III. 247; Hf. Ind. Fl. II. 195.

HAB. Frequent in the mixed forests, especially the upper ones, all over Burmah, from Arracan, Prome, and Martaban down to Upper Tenasserim.—Fl. March, Apr.; Fr. May, June.

3. B. PARVIFLORA, Roxb. Fl. Ind. III. 248; WA. Prod. I. 261; Wight Icon. t. 210. (*Spatholobus Roxburghii,* Bth. in Pl. Jungh. I. 238 in adn.; Hf. Ind. Fl. II. 193).

HAB. Frequent in all mixed forests, especially the upper ones, entering also occasionally the tropical and open forests; all over Chittagong, Pegu, and Martaban down to Tenasserim.—Fl. Febr.—Apr.; Fr. DS.

4. B. ACUMINATA, Wall. Cat. 5443. (*Spatholobus acuminatus,* Bth. in Pl. Jungh. I. 238 in adn.; Hf. Ind. Fl. II. 194).

HAB. Frequent in the tropical forests all over Pegu and Martaban down to Tenasserim; also Chittagong.—Fl. Fr. HS.

Erythrina, L.

Conspectus of Species.

* *Wings of corolla much longer than the spathaceous calyx.*

× Pod bearing the few seeds at or towards the narrowed end only, the lower sterile part greatly dilated as in *Butea.*

Subg. 1. *Hypaphorus,* Hassk. Pods dehiscing at both sutures, the pilated sterile part contracted into a stalk 1—2 in. long. Seeds 1—3, free. Flowers almost sessile.

Standard glabrous; keel-petals wholly connate, obcordate and shortly acuminate in the sinus, ... *E. lithosperma.*

Standard minutely velvety; keel consisting of 2 obliquely oblong rather acute petals united at the middle only, ... *E. holosericea.*

× × Pod many-seeded, seed-bearing from the base.

Subg. 2. *Duchassaingia,* Walp. Pods flat, torulose, opening only along the sinuate outer suture, the dorsal suture prominent and straight. Seeds free, but usually separated by spurious spongy septa.

Glabrous, glaucous; standard broad, notched; pods minutely greyish-velvety, .. *E. ovalifolia.*

Subg. 3. *Stenotropis,* Hassk. Pods torulose and almost moniliform, the valves opening at both sutures and exposing the continuous pithy-chartaceous indehiscent endocarp enclosing the seeds.

Glabrous; leaves membranous or chartaceous; pods glabrous, ... *E. Indica.*

* * *Wings of corolla minute, as long as or shorter than the spathaceous calyx.*

Subg. 4. *Micropteryx,* Walp. Pods follicle-like opening along the ventral suture, continuous. Seeds free.

Leaves rigidly chartaceous or almost coriaceous, more or less shortly tomentose or puberulous beneath; calyx spathaceously 2-lobed, ... *E. suberosa.*

Leaves chartaceous, glabrous, acuminate; calyx spathaceous, ... *E. stricta.*

1. E. LITHOSPERMA. Miq. Fl. Ind. Bat. I. 209, vix Bl.; Hf. Ind. Fl. II. 190. (*E. Sumatrana,* Miq. Suppl. Fl. Sum. 304).

HAB. Frequent on the small savannahs along hill-streams, river-sides, etc., in the vicinity of tropical forests, all over the Pegu Yomah and the Martaban hills.—Fl. Jan., Febr.; Fr. March, Apr.

The subgenera of *Erythrina* are better marked than many of the other Leguminous genera generally adopted by botanists. But here, like in *Sterculia,* the great uniformity of habit seems to be in favour of their reduction.

2. E. HOLOSERICEA, Kurz in Journ. As. Soc. Beng. 1873. 69.

HAB. Pegu, Tharrawaddi District (Dr. Adamson).

A curious species, the flowers of which much resemble those of *E. ovalifolia,* while the leaves (if they really belong to the flowers) are those of *E. lithosperma.*

3. E. OVALIFOLIA, Roxb. Fl. Ind. III. 254; Wight Icon. t. 247; Hf. Ind. Fl. II. 189. (*Duchassaingia ovalifolia,* Walp. in Linn. XXIII. 742).

HAB. Frequent in the tidal forests and the tidal savannahs of Lower Pegu; often also cultivated in villages.—Fl. Febr., March.

4. E. INDICA, Lamk. Encycl. Meth. II. 391; Roxb. Fl. Ind. III. 249; Wight Icon. t. 58; Hf. Ind. Fl. II. 188. (*E. bisetosa,* Griff. Not. Dicot. 441).

HAB. Frequent in the beach-forests all along the coasts of Burmah and the adjacent islands; recurs in the dry Prome District but there very rare; often planted in villages.—Fl. March, Fr. June, Sept.

5. E. SUBEROSA, Roxb. Fl. Ind. III. 253; Hf. Ind. Fl. II. 189. (*Micropteryx suberosa,* Walp. in Linn. XXIII. 744).

HAB. Not unfrequent in the upper mixed forests of the Pegu Yomah. —Fl. March, Apr.

6. E. STRICTA, Roxb. Fl. Ind. III. 251; WA. Prod. I. 260; Bedd. Fl. Sylv. t. 175; Hf. Ind. Fl. II. 189. (*Micropteryx stricta,* Walp. in Linnaea XXIII. 740).

HAB. Frequent in the upper mixed forests of the Pegu Yomah and the Martaban hills, east of Tounghoo.—Fl. March, Apr.; Fr. May, June.

Mucuna, Adans.

Conspectus of Species.

* *Pods winged along the sutures, or lamellate, or both.*

Subg. 1. *Citta,* Lour. Pods transversely and obliquely lamellate on the valves, but not winged on the sutures. Seeds orbicular.

Racemes corymb-like, short-peduncled; pods 1-seeded, ... *M. monosperma.*

Subg. 2. *Carpopogon,* Roxb. Sutures of pod dilated into broad wings, the valves smooth on the faces. Seeds orbicular.

Flowers yellowish or white; pod 3—4 in. long, appressed tawny setose, .. *M. gigantea.*

* * *Pods without sutural wings, the valves either quite plain, or longitudinally ribbed only on the faces.*

Subg. 3. *Stizolobium,* Pers. Characters as above. Pods often longitudinally ribbed on the sutures.

× Pods stalked, glabrescent, torose. Seeds orbicular.

Arboreous climber; flowers variegated dark-purple; pod 1—3 ft. long, plain, .. *M. macrocarpa.*

× × Pods sessile, plain or longitudinally ribbed. Seeds transversely oblong.

\+ Pods densely setose, not glabrescent. Flowers purple.

Peduncle naked; flowers arising from a knob; pods with two longitudinal ribs along the upper suture; leaves pubescent beneath, ... *M. pruriens.*

Peduncle bracted; flowers from a secondary peduncle about 2 lin. long; pod without ribs; leaves almost glabrous, ... *M. bracteata.*

\+ + Pods velvety, glabrescent. Flowers white.

Pods longitudinally ribbed, ½ ft. long, ... *M. nivea.*

1. M. MONOSPERMA, DC. Prod. II. 406; Wight in Hook. Bot. Misc. II. 346. suppl. t. 12, and Icon. t. 35; Hf. Ind. Fl. II. 185. (*Carpopogon monospermum,* Roxb. Fl. Ind. III. 283; *M. anguina,* Wall. Pl. As. rar. III. t. 236).

HAB. Frequent in the mixed forests, especially the lower ones, all over Pegu, Chittagong, and Arracan; also Tenasserim, Tavoy.—Fl. Close of RS.; Fr. DS.

2. M. GIGANTEA, DC. Prod. II. 405; Wight in Hook. Bot. Misc. II. 257; Suppl. t. 14; Hf. Ind. Fl. II. 186. (*Dolichos giganteus,* Willd. sp. pl. III. 287; *Carpopogon giganteum,* Roxb. Fl. Ind. III. 287).

HAB. Frequent along the sea-coast, especially in the beach-jungles, of the Andaman islands; also Tenasserim.—Fl. Fr. DS.

3. M. MACROCARPA, Wall. Pl. As. rar. I. 41. t. 47; Hf. Ind. Fl. II. 186.

HAB. Not unfrequent in the hill-forests, especially the drier ones, and in the pine forests of Martaban east of Tounghoo, at 4000 to 6000 ft. elevation; also Ava hills.—Fl. March; Fr. HS.

4. M. PRURIENS, DC. Prod. II. 405; Hf. Ind. Fl. II. 187. (*M. prurita,* Hook. Bot. Misc. II. 257. Suppl. t. 13; Bot. Mag. t. 4945;

Carpopogon pruriens, Roxb. Fl. Ind. III. 283; *Dolichos pruriens*, L. sp. pl. 1020, quoad plant. Asiat.; M. utilis, Wall.; Wight Icon. t. 280).

HAB. Frequent in all leaf-shedding forests, especially the lower ones, in hedges, shrubbery, etc., around villages, and along river-sides of the plains, all over Pegu and Prome; also Ava.—Fl. Close of RS.; Fr. C. and HS.

5. M. BRACTEATA, DC. Prod. II. 406; Kurz in Journ. As. Soc. Beng. 1873, 231; Hf. Ind. Fl. II. 186. (*Carpopogon bracteatum*, Roxb. Hort. Beng. 54).

HAB. Frequent in shrubbery along choungs in the tropical forests of Pegu and Martaban, ascending into the pine forests up to 4000 ft. elevation; also Ava and Chittagong.—Fl. CS.; Fr. HS.

N. B. A probably new species has been collected by Dr. Brandis somewhere in Pegu which is very near to *M. atropurpurea*, DC., and, indeed, has the same flowers. It differs in the long cuspidate leaflets, slender and short racemes, the lower persistent bracts, which are concave-ovate, long-acuminate, and about an inch long; and the lanceolate, acuminate calyx-lobes.

6. M. NIVEA, DC. Prod. II. 406; Hf. Ind. Fl. II. 188. (*Carpopogon niveum*, Roxb. Fl. Ind. III. 285).

HAB. Ava (*teste* Baker).

Pachyrrhizus, Rich.

1. P. BULBOSUS, (*Dolichos bulbosus*, L. sp. pl. 1020; Roxb. Fl. Ind. III. 309; *P. angulatus*, Rich. ap. DC. Mèm. Leg. IX 379; DC. Prod. II. 402; Hf. Ind. Fl. II. 207).

HAB. Frequently cultivated all over Burma.—Fl. Close of R. S. and CS.; Fr. CS.

Vigna, Savi.

Conspectus of Species.

* *Stipules not peltately attached. Keel prolonged into a distinct beak.*

× Ovary and pods (at least while young) more or less pubescent to tomentose. Flowers purple or blue.

O Seeds velvety.

Habit of the following; pods 2—3 in. long by ½ broad, densely silky villous, .. *V. dolichoides.*

O O Seeds glabrous.

Flowers about ½ in. long, forming short-peduncled many-flowered racemes; pods densely brown hirsute, 2½—3 lin. broad by 4—5 in. long, ... *V. pilosa.*

Flowers about an inch long or longer, by 2—4 terminating the long peduncles; pod glabrescent, ... *V. vexillata.*

× × Ovary and pods glabrous. Flowers yellow.

O Leaflets obovate, blunt or almost retuse.

Quite glabrous; corolla about ⅓ in. long; pods 1—1½ in. long, ... *V. lutea.*

O O Leaflets from ovate to ovate-lanceolate, acuminate to acute.

Flowers by 1—2 on very short paired peduncles, ... *V. repens.*
Racemes many-flowered, long-peduncled; stipules small, almost peltately falcate-ovate, .. *V. luteola.*

* * *Stipules peltately attached, the lower end produced.*

× Keel not prolonged into a beak. Flowers yellow.

Pods 1—2 in. long by $1\frac{1}{2}$—2 lin. broad, minutely puberulous, soon glabrous; seeds glossy; stipules oblong, the produced basal part falcate-ovate,...... *V. calcarata.*
Pods rather blunt at both ends, up to an in. long by $2\frac{1}{2}$ lin. broad, sparingly but long-hirsute; seeds opaque; stipules peltately linear-oblong, 3—4 lin. long, .. *V. brachycarpa.*

× × Keel prolonged into a distinct beak. Flowers blue or white, or variegated in these colours.

Pods 2—3, or 4—12 in. long by 2—4 lin. broad, glabrous; stipules shortly peltate, lanceolate, ... *V. Sinensis.*

1. V. DOLICHOIDES, Bak. in Hf. Ind. Fl. II. 206. (*Phaseolus dolichoides*, Roxb. Fl. Ind. III. 290; *Canavalia dolichoides*, Kurz in Journ. As. Soc. Beng. 1874. 185. sub No. 14).

HAB. Not unfrequent in the upper mixed forests of Chittagong and Arracan, especially along choungs.—Fl. Close of RS.; Fr. DS.

2. V. PILOSA, Bak. in Hf. Ind. Fl. II. 207. (*Dolichos pilosus*, Klein in Willd. sp. pl. III. 1043; Roxb. Fl. Ind. III. 312).

HAB. Prome (Wall. Cat. 5599 C.); Pegu, above Rangoon (Cleghorn).—Fl. Close of RS.; Fr. CS.

3. V. VEXILLATA, Bth. in Mart. Fl. Bras. XXIV. 194. t. 50. f. 1.; Hf. Ind. Fl. II. 206. (*Phaseolus vexillatus*, L. sp. pl. 1017; Jacq. Hort. Vindob. t. 102; *V. hirta*, Hook. Icon. plant. t. 637; *Phaseolus Pulniensis*, Wight Icon. t. 202).

HAB. Rather scarce in savannahs along the choungs in the upper mixed forests of the Pegu Yomah.—Fl. CS.

4. V. LUTEA, A. Gray in Bot. Amer. Expl. I. 454; Bth. Fl. Austr. II. 259; Hf. Ind. Fl. II. 205.

HAB. Frequent on the sand-beaches and in the beach-forests all along the coast of Tenasserim and the Andamans.—Fl. C. and HS.; Fr. HS.

5. V. REPENS, Bak. in Hf. Ind. Fl. II. 205.

HAB. Prome (Wall.). Not seen by me.

6. V. LUTEOLA, Bth. in Mart. Fl. Bras. Pap. 194. t. 50. f. 2 and Fl. Austr. II. 260. (*Dolichos luteolus*, Jacq. Hort. Vindob. I. 39. t. 90; *Dolichos Gangeticus*, Roxb. Fl. Ind. III. 310).

HAB. Ava, Bhamo (J. Anderson).—Fl. Febr.

Baker refers my Burmese specimens (No. 2526) to this species, but they differ greatly in the stipules, and are referred by me to the following species.

7. V. CALCARATA, (*Phaseolus calcaratus*, Roxb. Fl. Ind. III. 289; WA. Prod. I. 245; Hf. Ind. Fl. II. 203?).

HAB. Common in the savannahs and in grass-land, also amongst sunny shrubbery and in cultivated lands, all over Pegu, Arracan, and Martaban.—Fl. Fr. DS.

8. V. BRACHYCARPA, Kurz in Journ. As. Soc. Beng. 1874. 185; Hf. Ind. Fl. II. 206.

HAB. Arracan, upper mixed forests in the Akyab District.—Fl. Fr. Close of RS.

*9. V. SINENSIS, Savi Dissert.; Miq. Fl. Ind. Bat. I. 187. (*Dolichos Sinensis*, L. Amæn. Acad. IV. 326; Roxb. Fl. Ind. III. 302; WA. Prod. I. 251; Bot. Mag. t. 2232; *Dolichos Tranquebaricus*, Jacq. Hort. Vindob. III. t. 70; *Dolichos Catjang*, L. Mart. 259; Roxb. Fl. Ind. III. 303; *V. Catjang*, Endl. ap. Miq. Fl. Ind. Bat. I. 188; Hf. Ind. Fl. II. 205).

HAB. Generally cultivated all over Burma and adjacent islands.—Fl. Fr. DS..

Phaseolus, L.

Conspectus of Species.

Subg. 1. *Eu-phaseolus.* Stipules small, basifix and not or hardly produced downwards.

* *Pods dimidiate, oblong or linear, 2—many-seeded. Flowers purple to lilac and white.*

Flowers small, greenish white, on filiform puberulous pedicels; calyx shallow, 2 lin. wide and barely a line deep; pods falcate, 2—3 in. long by ½ broad, glabrous, *P. lunatus.*

Flowers purplish, middling sized, on slender glabrous pedicels; calyx about 2 lin. deep and nearly as wide, ribbed; pods 1½—2 in. long by 3—4 lin. broad, *P. tenuicaulis.*

* * *Pods neither dimidiate nor falcate, linear to narrow-linear, 4—many-seeded. Flowers purple to white.*

× Bractlets oval, persistent, as long as or longer than the calyx.

Racemes few-flowered; pedicels longer than the calyx; pods linear, 4—6-seeded, ..*P. vulgaris.*

× × Bractlets deciduous, shorter than the calyx. Flowers shortly pedicelled.

Corolla nearly an inch long; calyx plain; pods many-seeded, ⅓ in. broad, ..*P. adenanthus.*

Corolla about ½ in. long; calyx almost 5-ribbed; pods many-seeded, 2 lin. broad or narrower, ...*P. semierectus.*

Subg. 2. *Strophostyles*, Ellis. Stipules peltately attached and produced downwards. Flowers yellow or greenish yellow. Bracts very deciduous.

* *Ovary and pods glabrous.*

Prostrate or half-twining; stipules large and leafy, about ⅓ in. long; leaflets more or less deeply lobed, ...*P. trilobus.*

* * *Ovary pubescent to hirsute.*

Twining, the stems spreadingly hirsute; pedicels 1—1½ lin. long; pods thinly and shortly hirsute, ...*P. trinervius.*

Erect or nearly so, hirsute to almost glabrous; flowers almost sessile; pods sparingly but long-hirsute, ... *P. radiatus.*

*1. P. LUNATUS, L. sp. pl. 1016; Roxb. Fl. Ind. III. 286; Wight Icon. t. 755; Bak. in Fl. trop. Afr. 193 and Ind. Fl. II. 200.

HAB. Ava, apparently cultivated.—Fl. Febr.

2. P. TENUICAULIS, Bak. in Hf. Ind. Fl. II. 201. (*Dolichos tenuicaulis*, Grah. in Wall. Cat. 5598 D.)

HAB. Prome (Wall.); Ava, hills east of Bhamo (J. Anderson.)—Fl. Aug.

*3. P. VULGARIS, L. sp. pl. 1016; Roxb. Fl. Ind. III. 287; Bth. in Mart. Fl. Bras. Papil. 182; Hf. Ind. Fl. II. 200.

Var. β. NANUS, Koch. Syn. Fl. Germ. I. 178. (*P. nanus*, L. sp. pl. 1017; Roxb. Fl. Ind. II. 291; WA. Prod. I. 243), dwarf and erect.

HAB. Here and there cultivated in gardens, chiefly in Chittagong.

4. P. ADENANTHUS, E. Mey. Prim. Flor. Esseq. 239; Bak. in Fl. trop. Afr. II. 192 and Ind. Fl. II. 200. (*P. rostratus*, Wall. Pl. As. rar. I. t. 63; Wight Icon. t. 34; *P. alatus*, Roxb. Fl. Ind. III. 288, non L.).

HAB. Ava and Prome, on the hills bordering the Irawaddi (Wall.); Tenasserim (Helf.).—Fl. Close of RS. and CS.; Fr. HS.

5. P. SEMIERECTUS, L. sp. pl. 1016; Jacq. Icon. t. 558; Bot. Reg. t. 743; Hf. Ind. Fl. II. 201. (*P. psoraleoides*, WA. Prod. I. 246; Wight Icon. t. 249).

HAB. Chittagong, in grass-land.—Fl. CS.; Fr. C. and HS.

6. P. TRILOBUS, Ait. Hort. Kew. III. 30; Roxb. Fl. Ind. III. 298; Wight Icon. t. 94; Hf. Ind. Fl. II. 201. (*Glycine triloba*, L. Mant. 516; *Dolichos trilobatus*, L. Mant. 516; Burm. Fl. Ind. t. 50. f. 1).

HAB. Burma (according to Revd. F. Mason).

7. P. TRINERVIUS, Heyne ap. WA. Prod. I. 245; Bak. in Fl. trop. Afr. II. 193 and in Ind. Fl. II. 203.

HAB. Not unfrequent in the savannahs of Martaban, east of Toung-hoo, and elsewhere; also Upper Tenasserim.—Fl. Fr. March, Apr.

*8. P. RADIATUS, L. sp. pl. 1017; Roxb. Fl. Ind. III. 296; Miq. Fl. Ind. Bat. I. 197.

Var. α. RADIATUS, (*P. radiatus*, L. l. c.; *P. Mungo*, L. var. *radiatus*, Bak. in Hf. Ind. Fl. II. 203), more or less spreading and twining; pods shorter and more blunt.

Var. β. MUNGO, (*P. Mungo*, L. Mant. 101; Roxb. Fl. Ind. III. 292; Hf. Ind. Fl. II. 203; *P. max*, Roxb. Fl. Ind. III. 295), dwarf and erect; pods longer, narrower, and acuminate; seeds green or black. Of this there is also an almost glabrous form.

HAB. Var. β. generally cultivated all over Burma.—Fl. CS.; Fr. Begin of HS.

Dolichos, L.

Conspectus of Species.

Flowers by 1—3 clustered in the leaf-axils; calyx-teeth about so long as the tube; corolla yellow, ... *D. biflorus.*
Flowers by 1 or 2 on a short axillary peduncle; calyx-teeth shorter than the tube; corolla reddish? .... *D. lanceolatus.*

1. D. BIFLORUS, L. sp. pl. 1023; Roxb. Fl. Ind. III. 313; Hf. Ind. Fl. II. 210. (*Glycine uniflora*, Dalz. in Journ. Linn. Soc. XIII. 146 cum icon.).

HAB. Ava (*teste* Baker).

2. D. LANCEOLATUS, Grah. in Wall. Cat. 5547; Hf. Ind. Fl. II. 210.

HAB. Prome Hills (Wall.).—Fl. Sept. Octob.

Lablab, Savi.

*1. L. VULGARIS, Savi Dissert. 19. f. 8. a—c.; Wight Icon. t. 57. and 203. (*Dolichos Lablab,* L. sp. pl. 1019; Roxb. Fl. Ind. III. 305; Bot. Mag. t. 896; Hf. Ind. Fl. II. 209.; *Dolichos purpureus,* L. sp. pl. 1021; Smith Exot. Fl. t. 74; Bot. Reg. t. 830; *Dolichos Bengalensis,* Jacq. Hort. Vindob. II. t. 124; *Dolichos lignosus,* Roxb. Fl. Ind. III. 307; Bot. Mag. t. 380).

HAB. Generally cultivated in several varieties all over Burma and the adjacent islands.—Fl. Fr. CS.

Psophocarpus, Neck.

Conspectus of Species.

Bractlets shorter than the calyx; pods up to a foot long, 12—16 seeded, ..*P. tetragonolobus.*
Bractlets as long or longer than the calyx; pods 2—3 in. long, often only 5—6-seeded, ..*P. palustris.*

*1. P. TETRAGONOLOBUS, DC. Prod. II. 403; Hf. Ind. Fl. II. 211. (*Dolichos tetragonolobus,* L. sp. pl. 1021?).

HAB. Prome and Martaban; cultivated accord. Revd. F. Mason.

*2. P. PALUSTRIS, Desv. in Ann. d. sc. nat. IX. 420; Hf. Ind. Fl. II. 212. (*Diesingia scandens,* Endl. Atakt. I. t. 1—2; *P. longepedunculatus,* Hassk. Pl. Jav. rar. 388; Bak. in Fl. trop. Afr. II. 208; *Dolichos tetragonolobus,* Roxb. Fl. Ind. III. 305, non Linn.?).

HAB. Frequently cultivated all over Burma; growing also like wild in the savannahs around villages along the Irrawaddi river.—Fl. Oct. Jan.; Fr. C. and HS.

Canavalia, Adans.

Conspectus of Species.

Subg. 1. *Eu-canavalia.* Pods more or less dimidiate, with 2 parallel wings along the upper suture, glabrous or glabrescent.

* *Seeds an inch long or slightly longer.*

Pods $\frac{1}{2}$—2 feet long, linear-oblong; seeds red or white, ...*C. ensiformis.*

* * *Seeds only $\frac{1}{2}$ in. long.*

Leaflets shortly acuminate or apiculate; standard an inch long; seeds light grey, ..*C. virosa.*

Leaflets apiculate; standard $\frac{3}{4}$ in. long or shorter; seeds dark brown, ...*C. turgida.*

Leaflets oboval, retuse or rounded; standard an inch long; seeds grey, ..*C. obtusifolia.*

Subg. 2. *Dysolobium*, Bth. Pods terete, straight or slightly curved, obtusely 2-keeled along both sutures, but not winged, densely hirsute to velvety.

Shortly pubescent; corolla an inch long or longer; style bearded; pods velvety, *C. grandis.*

Glabrescent; corolla hardly $\frac{1}{2}$ in. long; pod as in preceding, but more densely velvety, style villous round the stigma, ...*C. lucens.*

*1. C. ENSIFORMIS, DC. Prod. II. 404; Bot. Mag. t. 4027; Bak. in Fl. trop. Afr. II. 190 and Ind. Fl. II. 195. (*Dolichos ensiformis*, L. sp. pl. 1022; *C. gladiata*, DC. l. c.; Wight Icon. t. 753; *Dolichos gladiatus*, Jacq. Icon. rar. III. t. 560; Roxb. Fl. Ind. III. 300).

Var. *α.* ERYTHROSPERMA, Voigt Hort. Calc. 234, seeds red; flowers red or white.

Var. *β.* LEUCOSPERMA, Voigt Hort. Calc. 234, seeds and flowers white; pods about 2 feet long.

HAB. Generally cultivated all over Burma, especially in the plains; often springing up in poonzohs and neglected gardens.—Fl. RS.; Fr. CS.

2. C. VIROSA, WA. Prod. I. 253; Miq. Fl. Ind. Bat. I. 216. (*Dolichos virosus*, Roxb. Fl. Ind. III. 301; *C. ensiformis*, var. 1. *virosa*, Bak. in Hf. Ind. Fl. II. 196).

HAB. Amongst shrubbery along the outskirts of the upper mixed forests along the Arracan coast, and most probably elsewhere.—Fl. Close of RS.; Fr. Jan.

3. C. TURGIDA, Grah. in Wall. Cat. 5534; Miq. Fl. Ind. Bat. I. 215. (*C. ensiformis*, var. 2. *turgida*, Bak. in Hf. Ind. Fl. II. 196).

HAB. Frequent in the leaf-shedding forests, and more especially in shrubbery along streamlets, in hedges, etc., all over Burma, from Chittagong and Prome down to Tenasserim and the Andamans.—Fl. Close of RS.; Fr. CS.

4. C. OBTUSIFOLIA, DC. Prod. II. 404; Clegh. in Madr. Journ. new ser. I. t. 4; Hf. Ind. Fl. II. 196. (*Dolichos rotundifolius*, Vhl. Symb. II. 81; Roxb. Fl. Ind. III. 302).

HAB. Common on the sand-beaches all along the coasts of Arracan and the Andamans.—Fl. Close of RS.; Fr. CS.

5. C. GRANDIS, Kurz in Journ. As. Soc. Beng. 1874. 185 sub No. 14. (*Phaseolus grandis*, Wall. Cat. 5602; Bth. in Pl. Jungh. I. 239 in adn.; *Phaseolus velutinus*, Bak. in Hf. Ind. Fl. III. 204).

HAB. Chittagong; Ava, Taong-dong and Khakyen hills; Tenasserim, Moulmein; Pegu (*teste* Baker).—Fl. Close of RS.; Fr. HS.

6. C. LUCENS, Kurz in Journ. As. Soc. Beng. 1874. 185 sub No. 14. (*Phaseolus lucens*, Wall. Cat. 5601; Bth. in Pl. Jungh. I. 239 in adn.; *Vigna lucens*, Bak. in Hf. Ind. Fl. II. 207).

HAB. Frequent in the mixed forests, especially the upper ones, entering also the tropical forests, from Chittagong, Pegu, and Martaban down to Tenasserim.—Fl. Close of RS.; Fr. HS.

Dioclea, HBK.

1. D. REFLEXA, Hook. Fl. Nigr. 306; Bak. in Fl. trop. Afr. II. 189; Hf. Ind. Fl. II. 196. (*Dolichos hexandrus*, Roxb. Hort. Bengh. 55. and MS. Icon. XX. t. 134).

HAB. Tenasserim (Helf. 1752).

Pueraria, DC.

Conspectus of Species.

Subg. 1. *Eu-pueraria.* Woody leaf-shedding climbers. Pods constricted between the seeds. Roots large, tuberous. Flowers pale blue.

Calyx densely silky; bractlets minute; pods tawny hirsute while young, ..*P. tuberosa.*

Calyx minutely appressed pubescent; bractlets as long as the buds; pods minutely appressed pubescent, soon glabrous, ...*P. Candollei.*

Subg. 2. *Neustanthus*, Bth. Undershrubs or shrubs, erect or twining. Pods not constricted between the seeds.

* *Erect shrubs or undershrubs, the branchlets terete or nearly so.*

× Bracts deciduous.

Tomentum of young parts, inflorescence, and calyx tawny; pods 2—3 in. long, ..*P. composita.*

All parts nearly glabrous; calyx minutely velvety; pods $1\frac{1}{2}$—2 in. long; flowers white, ..*P. Wallichii.*

× × Bracts persistent.

Leaves sparingly appressed hirsute; fruiting pedicels 2 lin. long; pods 1—$1\frac{1}{2}$ in. long, glabrous, ...*P. stricta.*

* * *Twining or prostrate herbs or undershrubs. Flowers purplish blue.*

× Pods narrowly linear, $1\frac{1}{2}$—3 in. long by 2 lin. broad, many-seeded.

O Bracts deciduous. Branchlets terete or nearly so. Leaflets often lobed. Extensive twiners (*Schizophyllon*, Baker.)

Calyx about $2\frac{1}{2}$ lin. long, the lobes acuminate; corolla about 5 lin. long, *P. phaseoloides.*

Calyx about 4 lin. long, the lobes subulate-acuminate; corolla $\frac{3}{4}$ in. long, ..*P. subspicata.*

O O Bracts persistent. Branchlets somewhat angular. Prostrate or twining perennial herbs.

Pods long but thinly hirsute,..*P. anabaptista.*

× × Pods oblong to linear-oblong, ½—1 in. long by 2½—3½ lin. broad, flat or torose. Branchlets sharply angular, retrorsely pubescent on the angles.

Pods flat or nearly so, sparingly but long and spreadingly hirsute, 2—4-seeded; calyx small, ...*P. hirsuta.*

Pods torose, shortly and sparingly appressed hirsute, 5—6-seeded; calyx nearly a line long,..*P. brachycarpa.*

1. P. TUBEROSA, DC. Prod. II. 240; Wight Icon. t. 412; Hf. Ind. Fl. II. 197. (*Hedysarum tuberosum*, Roxb. Fl. Ind. III. 363).

HAB. Chittagong.—Fl. March, Apr.; Fr. May, June.

2. P. CANDOLLEI, Grah. in Wall. Cat. 5355; Hf. Ind. Fl. II. 197.

HAB. Common in the mixed forests, especially the upper ones, all over Burma, from Ava and Martaban down to Tenasserim.—Fl. March. Apr.; Fr. May, June.

Stands in a similar relationship to the preceding species as *Millettia extensa* does to *M. macrophylla*, and is barely more than a glabrous variety of it.

3. P. WALLICHII, DC. Prod. II. 240, and Mém. Legum. t. 43: Hf. Ind. Fl. II. 198.

Var. *α.* GENUINA, all parts nearly glabrous; calyx minutely velvety; pods 1½—2 in. long; flowers white.

Var. *β.* COMPOSITA, Bth. in Linn. Proc. IX. 124. (*P. composita*, Grah. in Wall. Cat. 5570), tomentum of the young parts, and of the inflorescence and calyx, of a tawny colour; pods 2—3 in. long; flowers apparently purple.

HAB. Var. *α.* Burma (*teste* Benth.); var. *β.* frequent in the drier hill-forests, especially the pine-forests, of Martaban, east of Tounghoo, at 3500 to 5000 feet. elevation; Ava, Taong-dong (Wall).—Fr. March.

I think that var. *β.* will have to be separated specifically.

4. P. STRICTA, Kurz in Journ. As. Soc. Beng. 1873, 254; Hf. Ind. Fl. II. 198.

HAB. Rather frequent in the hill-eng and the upper dry-forests, rare in the drier upper mixed forests of the Pegu Yomah and the Martaban hills, at 1000—3000 feet elevation.—Fr. DS.

5. P. PHASEOLOIDES, Bth. in Proc. Linn. Soc. IX. 125; Hf. Ind. Fl. II. 199 excl. syn. Bth. (*Dolichos phaseoloides*, Roxb. Fl. Ind. III. 316).

HAB. In hedges and light woods of Pegu (Maclelland); Prome (Wall.); probably all over the country.—Fl. Close of RS.; Fr. DS.

6. P. SUBSPICATA, Bth. in Proc. Linn. Soc. IX. 125.

HAB. Frequent in the mixed, especially the savannah-forests, of Arracan and Pegu; also Tenasserim, Tavoy.—Fl. Close of RS.; Fr. CS.

7. P. ANABAPTISTA (*Shuteria hirsuta*, Bak. in Hf. Ind. Fl. II. 182?).

Var. *α.* GENUINA, branches, petioles, etc., spreadingly tawny hirsute; pods similarly hirsute while unripe; flowers purple.

Var. *β.* GLABRESCENS, branches, petioles, and also the pods thinly appressed hirsute, the last shorter and almost glabrescent; flowers pale lilac, violet at the tips.

HAB. Both varieties rather frequent in the upper mixed forests, along choungs, also in hill-toungyas, of the Pegu Yomah; also Ava, Khakyen Hills.—Fl. begin of CS.; Fr. HS.

Var. *β.* may be distinct and stands in a similar relation to the normal form as *P. Candollei* does to *P. tuberosa.* The species is also common in the Sikkim Himalaya.

8. P. HIRSUTA, Kurz in Journ. As. Soc. Beng. 1873, 254; Hf. Ind. Fl. II. 199.

HAB. Not rare in the drier upper mixed forests of the western slopes of the Pegu Yomah, up to 3000 feet elevation.—Fr. Jan.

9. P. BRACHYCARPA, Kurz in Journ. As. Soc. Beng. 1873. 232 and 1874. 185; Hf. Ind. Fl. II. 199.

HAB. Rare in the drier upper mixed forests of the central parts of the Pegu Yomah.—Fr. Jan.

Teramnus, Spreng.

Conspectus of Species.

* *Pods more or less torose, tawny hirsute.*

Seeds opaque; inflorescence and young branches spreadingly tawny pilose; calyx-teeth as long as the tube, ... *T. mollis.*

* * *Pods glabrous to the naked eye.*

× Flowers in racemes.

Racemes appressed silk-hairy; calyx-teeth as long as the tube; seeds glossy; leaflets up to $1\frac{1}{2}$ in. long, not acuminate, ... *T. labialis.*

Racemes long-peduncled, almost glabrous; leaflets obovate, retuse, ... *T. Wallichii.*

Racemes appressed silk-hairy; calyx-teeth shorter than the calyx-tube; seeds quite opaque; leaves 2—4 in. long, acuminate, ... *T. flexilis.*

× × Flowers by 2—4, axillary.

Habit of *T. flexilis;* corolla $\frac{1}{2}$ in. long; unripe pods $1\frac{1}{2}$ in. long, flat, glabrous. .. *T. oxyphylla.*

1. T. MOLLIS, Bth. in Linn. Proc. VIII. 265. (*Glycine mollis,* WA. Prod. I. 208; *Glycine debilis,* Roxb. Fl. Ind. III. 317, *vix* Aiton).

HAB. Frequent in the drier upper mixed forests all over the Pegu Yomah.—Fl. RS.; Fr. CS.

2. T. LABIALIS, Spreng. Syst. veget. II. 235; Bth. in Linn. Proc. VIII. 265; Hf. Ind. Fl. II. 184, in part. (*Glycine labialis,* L. suppl. 325; Roxb. Fl. Ind. III. 315; Wight Icon. t. 168).

HAB. Frequent in savannahs and savannah-forests, also in hedges,

shrubbery and neglected culture-land, of Chittagong and Arracan ; probably also elsewhere.—Fl. Fr. RS.

3. T. Wallichii, (*Desmodium Rottleri*, Bak. in Hf. Ind. Fl. II. 174 quoad plant. e Prome).

Hab. Prome Hills (Wall. Cat. 5974).

The few specimens seen by me are imperfect, but the terete stems, and more especially the large peculiar peltately adnate stipules, at once remove it from *Desmodium Rottleri*, with which Baker identifies the plant.

4. T. flexilis, Bth. in Linn. Proc. VIII. 265 ; Hf. Ind. Fl. II. 185.

Hab. Not unfrequent in the moister upper mixed and in the tropical forests of Chittagong, Arracan, and Southern Pegu to Tenasserim.—Fl. Close of RS. ; Fr. CS.

5. T. oxyphylla. (*Galactia? oxyphylla*, Bth. in Pl. Jungh. I. 253 in adn. ; Hf. Ind. Fl. II. 192).

Hab. Tenasserim, Amherst (Parish) ; Tavoy (Gomez).

Glycine, L.

Conspectus of Species.

Erect ; flowers in small axillary clusters ; pods 1—1½ in. long, almost falcate ; seeds 3 lin. long, slightly compressed, pale coloured, ... *G. Soja.*

Twining ; flowers in peduncled axillary racemes ; pods ½—1 in. long, straight ; seeds a line long, compressed, brown, ... *G. Javanica.*

1. G. Soja, Sieb. and Zucc. Fam. Nat. Fl. Jap. 11 ; Bth. in Linn. Proc. VIII. 265 ; Hf. Ind. Fl. II. 184. (*Dolichos Soja*, L. sp. pl. 1021 ; Roxb. Fl. Ind. III. 314 ; Jacq. Icon. rar. t. 145 ; *Soya hispida*, Moench Meth. 153 ; DC. Prod. III. 396 ; Alef. in Bot Ztg. 1867. 290).

Hab. Ava, cultivated.

Dunbaria, WA.

Conspectus of Species.

* *Ovary and pods sessile.*

Leaflets large, acuminate, sparingly but distinctly resinous-dotted beneath ; flowers in racemes, ... *D. fusca.*

Leaflets small, bluntish ; flowers usually by pairs, ... *D. conspersa.*

* * *Ovary and pods conspicuously stalked.*

Leaflets acuminate ; flowers usually by pairs or few on a very short peduncle ; pods pubescent, 1½—2 in. long, 10—12-seeded, long-stalked, ... *D. podocarpa.*

Leaflets acute ; flowers in racemes ; pods spreadingly viscose-hairy, 1—1½ in. long, 5—6-seeded, shortly stalked, ... *D. circinalis.*

1. D. fusca, Kurz in Journ. As. Soc. Beng. 1874, 186. (*Phaseolus fuscus*, Wall. Pl. As. rar. I. 6. t. 6 ; Hf. Ind. Fl. II. 204).

Hab. Prome Hills (Wall.).—Fl. Febr., March.

2. D. conspersa, Bth. in Pl. Jungh. I. 241 ; Hf. Ind. Fl. II. 218. (*Dolichos ? rhynchosioides*, Miq. Fl. Ind. Bat. I. 177).

HAB. Prome Hills (Wall.).—Fl. Sept. Octob.

3. D. PODOCARPA, Kurz in Journ. As. Soc. Beng. 1874, 185; Hf. Ind. Fl. II. 218.

HAB. Upper Tenasserim, Moulmein (Falconer; Helf. 1709).—Fl. Fr. Febr. March.

4. D. CIRCINALIS, Bak. in Hf. Ind. Fl. II. 219. (*Atylosia circinalis*, Bth. Pl. Jungh. I. 244 in adn.).

HAB. Tenasserim, Moulmein, etc., (Griff., Helf.) *teste* Baker.

I have seen no Burmese specimens of this species, which greatly resembles the preceding.

Atylosia, WA.

Conspectus of Species.

* *Twining undershrubs or herbs.*

× Prostrate herb with twining branches. Flowers 3—4 lin. long, almost fascicled by 2—3.

Puberulous; pods $\frac{1}{2}$—1 in. long, tawny puberulous and hirsute, ... *A. scarabæoides.*

× × Corolla $\frac{1}{2}$—$\frac{3}{4}$ in. long. Extensive twiners. Flowers racemose.

Leaflets shortly pubescent on both sides; racemes and pods long-pilose, the latter transversely torose, long-acuminate, ... *A. barbata.*

Leaflets beneath softly (often yellowish) puberulous; pods oblong, transversely impressed between the seeds, yellowish or tawny velvety, ... *A. mollis.*

* * *Erect shrubs or herbs.*

Stiff annual, little-branched; leaflets beneath closely white or yellowish tomentose; calyx slightly puberulous or almost glabrous; corolla $\frac{1}{2}$ in. long, ... *A. nivea.*

1. A. SCARABÆOIDES, Bth. in Pl. Jungh. I. 242; Hf. Ind. Fl. II. 215. (*Dolichos scarabæoides*, L. sp. pl. 1020; *Dolichos medicagineus*, Roxb. Fl. Ind. III. 315, non Willd.).

HAB. Ava, Bhamo (J. Anderson).—Fr. Jan.

2. A. BARBATA, Bak. in Hf. Ind. Fl. II. 216. (*Dunbaria barbata*, Bth. in Pl. Jungh. I. 242 in adn.; *Dunbaria calycina*, Miq. Fl. Ind. Bat. I. 180).

HAB. Frequent in all leaf shedding forests and in the savannahs, also in hedges, etc., all over Pegu and Martaban down to Tenasserim; also Ava and Prome.—Fl. Fr. C. and HS.

3. A. MOLLIS, Bth. in Pl. Jungh. I. 243 in adn.; Hf. Ind. Fl. II. 213. (*Dunbaria Horsfieldii*, Miq. Fl. Ind. Bat. II. 179).

HAB. Not unfrequent in the savannah forests, also in the open and the mixed forests, of Martaban and Ava; also Andamans.—Fl. CS.; Fr. HS.

4. A. NIVEA, Bth. in Pl. Jungh. I. 243 in adn.; Hf. Ind. Fl. II. 214.

HAB. Not unfrequent in the eng-forests of the Prome district; Ava, Yenang-choung (Wall.).

Cajanus, DC.

* 1. C. INDICUS, Spreng. Syst. III. 248; Alef. in Bot. Zeitg. 1867. 289; Hf. Ind. Fl. II. 217. (*Cytisus cajan*, L. sp. pl. 1041; Roxb. Fl. Ind. III. 325; *Cytisus pseudo-cajan*, Jacq. Hort. Vindob. t. 119; *C. flavus*, DC. Prod. II, 402; Jacq. Obs. I. t. 1.).

HAB. Generally cultivated in several varieties all over Burma and the adjacent islands, up to 3000 feet elevation.—Fl. Fr. C. S.

Cylista, Ait.

1. C. SCARIOSA, Ait. Hort. Kew. IV. 513; Roxb. Corom. Pl. I. t. 92 and Fl. Ind. III. 320; Wight Icon. t. 1597; Hf. Ind. Fl. II. 219.

HAB. Frequent in the leaf-shedding forests, especially the mixed ones, also in deserted toungyas, savannahs, etc., all over Pegu and Martaban —Fl. Close of RS; Fr. HS.

Rhynchosia, Lour.

Conspectus of Species.

Subg. 1. *Eu-Rhynchosia*, Seeds without arillus.

* *Pods very much longer than the calyx.*

× Twining herbs.

Leaflets more or less acute; racemes elongate, longer than the leaves, almost glabrous, ..*R. minima.*

Leaflets obtuse or rounded; racemes filiform, shorter than the leaves, pilose; calyx-teeth filiform,.. *R. pilosa*

× × Erect shrubs or undershrubs.

Greyish velvety; racemes longer than the leaves, panicled at the end of the branches, pod densely velvety, ...*R. bracteata.*

* * *Calyx as long as the corolla, in fruit nearly as long as the pod. Twiners.*

Flowers in dense short axillary racemes; pods long-pilose, short, ...*R. densiflora.*

Subg. 2. *Phyllomatia*, WA. (incl. *Nomismia*, WA. and *Ptychocentrum*, WA.). Seeds with a waxy arillus.

* *Calyx-teeth broad, enlarging and leafy in fruit.*

Half-twining, thinly pubescent; flowers singly on the filiform viscid-pubescent racemes, pods 1-seeded, ...*R. rufescens.*

* * *Calyx-teeth lanceolate, acuminate, not enlarging.*

Erect; stems, racemes, and undersurface of leaflets white-tomentose; pods 2-seeded, ...*R. candicans.*

1. R. MINIMA, DC. Prod. II. 385; Bth. in Fl. Austr. II. 267; Hf. Ind. Fl. II. 223. (*Dolichos minimus*, L. sp. pl. 1020; *Dolichos scarabæoides*, Roxb. Fl. Ind. III. 315, *non* Willd.).

HAB. In the dry and open forests, also in savannahs, of Prome and Ava.—Fl. Fr. Close of RS.

2. R. PILOSA, Wall. Cat. 5499; Hf. Ind. Fl. II. 224.

HAB. Ava, banks of the Irrawaddi near Segain (Wall.).

The foliage resembles that of *Atylosia scarabæoides*, the flowers those of *Atylosia elongata*, Bth.

3. R. BRACTEATA, Bth. in Hf. Ind. Fl II. 225.

HAB. Not unfrequent in the dry and eng-forests of the Prome district; Ava, Yenang-choung and Taong-dong (Wall.).—Fl. Fr. DS.

4. R. DENSIFLORA, DC. Prod. II. 386; Hf. Ind. Fl. II. 226. (*Dolichos aurantiacus*, Wall. Cat. 5492 E.).

HAB. Ava, limestone hills near Segain; Taong-dong (Wall.).—Fl. Nov.

5. R. RUFESCENS, DC. Prod. II. 387; Hook. Icon. t. 189; Hf. Ind. Fl. II. 220. (*Cyanospermum Javanicum*, Miq. Fl. Ind. Bat. I. 167).

HAB. Ava, Irrawaddi valley near Katha (J. Anderson).—Fl. Jan.

6. R. CANDICANS, (*Cajanus? candicans*, Wall. Cat. 5576; *Atylosia candicans*, Kurz in Journ. As. Soc. Beng. 1874, 186. (*R. Avensis*, Bth. MS.; Hf. Ind. Fl. II. 222; *Dolichos candicans*, Wall. Cat. 5567; Hf. Ind. Fl. II. 226, forma foliolis acutis v. obtusiusculis).

HAB. Ava, banks of the Irrawaddi below Yenang-choung; also Taong-dong (Wall.).—Fl. Nov.

Flemingia, Roxb.

Conspectus of Species.

Subg. 1. *Eu-Flemingia.* Erect shrubs or herbs. Flowers in racemes, panicles or head-like spikes.

§ 1. *Ostryodium*, DC. Racemes one-sidedly flowered, the upper ones collected into a terminal panicle. Floral bracts large, leafy, complicate, persistent. Leaves 1-foliolate. Pods 2-seeded.

× Floral bracts quite glabrous.

Corolla yellowish, $\frac{1}{3}$ in. long; leaves cordate-ovate, ... *F. chappar.*

× × Floral bracts puberulous or pubescent.

Stipules not above 3 lin. long, rather deciduous; bracts rotundate and obsoletely pointed, not ciliate; corolla about 3 lin. long, white or yellowish, .. *F. strobilifera.*

Stipules stiff-subulate, up to $\frac{1}{2}$ in. long; bracts more or less retuse, ciliate; corolla purplish, about 2 lin. long, ... *F. bracteata.*

§ 2. *Flemingiastrum.* DC. (incl. *Chalaria*, WA.). Racemes spikelike, solitary or clustered in the leaf-axils, or in panicles, rarely reduced to axillary or terminal more or less involucred heads.

× Flowers in racemes or panicles. Pods usually few-seeded.

+ Leaves 1—3-foliolate. Bracts small, persistent or deciduous (*Chalaria*, WA.).

Leaves 1-foliolate; racemes filiform, shorter than the leaves, ... *F. paniculata.*

Leaves 3-foliolate; racemes slender, as long or usually longer than the leaves, .. *F. lineata.*

+ + Leaves digitately 3-foliolate. Spikes, while young, densely imbricate-bracted, the bracts deciduous long before opening of the flowers, or rarely persistent.

O Bracts not scarious, shorter than, or about as long as the buds. Low shrubs, the branches more or less terete or angular.

† Bracts persistent during flowering time.

Racemes dense, sessile; corolla 3 lin. long; calyx-lobes subulate, the lower one $2\frac{1}{2}$ lin. long; petioles less than an inch long, ... *F. Grahamiana.*

Racemes dense, villous, the broad bracts much shorter than the pilose calyx; calyx-teeth $3-3\frac{1}{2}$ lin. long, linear, subulate-acuminate; corolla slightly longer than the calyx; petiole 1—2 in. long, not winged, ... *F. Wallichii.*

† † Bracts deciduous before opening of the flowers.

¶ Low shrubs with a woody subterranean trunk.

Racemes small, silvery silk-hairy; calyx-teeth falcately subulate, a line long, the lowermost one $1\frac{1}{2}$ lin. long; corolla 2 lin. long; petiole winged, about an inch long, ..*F. sericans.*

As preceding, but flowers somewhat larger and not silvery silk-hairy; petiole 3—6 in. long and longer, winged, ... *F nana.*

Racemes rather slender and lax; flowers almost sessile; corolla 2 lin. long or a little longer; calyx-teeth falcate-lanceolate, the lowermost one barely longer than the rest; petiole winged, 1—2 in. long, ... *F. ferruginea.*

¶ ¶ Well-developed undershrubs.

Petiole usually not winged; racemes dense, usually clustered and shorter than the petiole, greyish silk-hairy; bracts linear-lanceolate, subulate-acuminate, about 4 lin. long; calyx $3\frac{1}{2}$ lin. long, the lobes linear, subulate-acuminate, the lowermost much longer; corolla $3\frac{1}{2}$ lin. long, purplish, with a flesh-coloured purplish-streaked standard, ... *F. congesta.*

As preceding; racemes appressed tawny-pubescent, much shorter than the narrowly winged petiole; pods densely resinose-glandular and puberulous, ...*F. prostrata.*

Petiole narrowly winged; racemes rather lax, greyish silk-hairy; calyx 3 lin. long, the lobes subulate; bracts ovate-lanceolate, cuspidate; corolla 3 lin. long, rose-coloured with greenish keel; pods puberulous, ...*E. semialata.*

Petiole narrowly winged; bracts and calyx appressedly brown or golden silk-hairy, the latter $\frac{1}{2}$ in. long, the lobes subulate with the lowermost one twice as long; corolla $\frac{1}{2}$ in. long, white with rose-coloured wings, ...*F. latifolia.*

O O Bracts scarious and stiff, very much longer than the flower buds. Branches and branchlets more or less triquetrous.

Tall undershrub; petiole narrowly winged; lower sheathing bracts up to 2 in. long; calyx about 4 lin. long, silvery silk-hairy, the lobes linear, acuminate, the lowermost one twice as long; corolla nearly $\frac{1}{3}$ in. long; pods minutely appressed puberulous, ...*F. stricta.*

× × Spikes short and condensed into heads. Bracts all persistent, the outer ones large and involucre-like. Pod enclosed in the calyx, 1-seeded. (*Lepidocoma*, Jungh.)

Erect undershrub; bracts silky-pilose; calyx $\frac{1}{2}$ in. long, the lobes subulate; corolla $\frac{1}{2}$ in. long, minutely appressed silk-hairy; pods silky-pilose, ...*F. capitata.*

Subg. 2 *Rhynchosioides*, Bak. Twining herbs or perennials. Flowers in long peduncled heads or dichotomous corymbs. Calyx-teeth almost equal. Pods 1- rarely 2-seeded, usually included in the calyx. Bracts minute, deciduous.

Flowers by 4—10 in long-peduncled heads; calyx fulvous-pilose, $\frac{1}{3}$ in. long; corolla appressed pilose, nearly $\frac{1}{2}$ in. long, ... *F. vestita.*

1. F. CHAPPAR, Ham. in Wall. Cat. 5757; Hf. Ind. Fl. II. 227.

HAB. Frequent in the eng- and dry forests of Ava, Prome, Pegu, and Martaban.—Fl. CS.; Fr. HS.

2. F. STROBILIFERA, RBr. in Ait. Hort. Kew. ed. 2. IV. 350; Wight Icon. t. 267; Bot. Reg. t. 617; Hf. Ind. Fl. II. 227. (*Hedysarum strobiliferum*, L. sp. pl. 1053; Roxb. Fl. Ind. III. 350).

HAB. Common in all leaf-shedding forests and in the savannahs, all over Burma, from Chittagong and Ava down to Tenasserim and the Andamans.—Fl. R. and CS.; Fr. HS.

3. F. BRACTEATA, Wight Icon. t. 268; Miq. Fl. Ind. Bat. I. 162. (*F. strobilifera* var. 1. *bracteata*, Bak. in Hf. Ind. Fl. II. 227; *Hedysarum bracteatum*, Roxb. Fl. Ind. III. 351).

HAB. Frequent in all leaf-shedding forests, especially the lower mixed and savannah forests, all over Burma, from Ava and Martaban down to Pegu.—Fl. Close of RS. and CS.; Fr. HS.

4. F. PANICULATA, Wall. Cat. 5759; Bth. in Pl. Jungh. I. 245 in adn.; Hf. Ind. Fl. II. 227.

HAB. Upper Tenasserim, Attaran river (Wall., Helf.).—Fl. CS.

5. F. LINEATA, Roxb. Fl. Ind. III. 341; Wight Icon. t. 327; Hf. Ind. Fl. II. 228. (*Hedysarum lineatum*, L. sp. pl. 1054; Burm. Fl. Ind. 167. t. 53. f. 1).

HAB. Common in the savannahs and the lower mixed forests, also in grass-lands, etc., all over Ava, Prome, and Pegu; also Martaban.—Fl. CS.; Fr. HS.

6. F. SERICANS, Kurz in Journ. As. Soc. Beng. 1874, 186.

HAB. Frequent in the eng-forests of Prome district and of Martaban, east of Tounghoo.—Fl. Fr. HS.

7. F. FERRUGINEA, Grah. in Wall. Cat. 5750; Bth. in Pl. Jungh. I. 245 in adn.

HAB. Prome, frequent in the eng-forests; Ava, Taong-dong (Wall.).—Fl. Fr. March.

Habit of *F. Wightiana*, but the flowers very small and the calyx perfectly different.

8. F. CONGESTA, Roxb. Hort. Bengh. 56 and Fl. Ind. III. 340; Wight Icon. t. 390; Miq. Fl. Ind. Bat. I. 164; Hf. Ind. Fl. II. 228.

HAB. Frequent in alluvial grass-lands, especially in the savannah-forests, all over Pegu and Martaban down to Tenasserim; also Ava.—Fl. Close of RS.; and CS.; Fr. C. and HS.

9. F. PROSTRATA, Roxb. Fl. Ind. III. 338; Bth. in Pl. Jungh. I. 245 in adn.

HAB. Not unfrequent in the drier hill- (especially the pine-) forests of the Martaban Hills, east of Tounghoo, at 4000 to 5000 feet elevation.—Fr. March.

The Burmese variety differs from Khasi specimens chiefly in the long-acuminate not wrinkled leaflets and the black-glandular pods.

10. F. SEMIALATA, Roxb. Fl. Ind. III. 340; Wight Icon. t. 726; WA. Prod. I. 241. (*F. congesta*, var. 1. *semialata*, Bak. in Hf. Ind. Fl. II. 229 in part).

Var. *α*. GENUINA, racemes elongate, more robust.

Var. *β*. VIRIDIS, racemes simple, more lax and slender; more silk-hairy, always clustered in the axils of the leaves, and much shorter than the petiole; leaves of a thinner texture or less pubescent; flowers and pods usually smaller.

HAB. Var. *β*. only, but this common enough, in the leaf-shedding forests and in grassy or shrubby places, more especially in the savannahs, all over Burma, from Chittagong and Ava down to Tenasserim.—Fl. CS.; Fr. HS.

11. F. LATIFOLIA, Bth. in Pl. Jungh. I. 246; Miq. Fl. Ind. Bat. I. 163. (*F. congesta*, var. 2. *latifolia*, Bak. in Hf. Ind. Fl. II. 229).

Var. *α*. GENUINA, racemes more lax and more slender, branched; flowers smaller.

Var. *β*. GRANDIFLORA, racemes simple, shorter and more dense; flowers about $\frac{1}{3}$ larger.

HAB. Var. *β*. rather frequent in the hill-eng-forests and the drier hill- (chiefly the pine-) forests of the Martaban Hills, east of Tounghoo, at 2000—4000 feet elevation.—Fl. March.

12. F. STRICTA, Roxb. Corom. Pl. III. t. 248 and Fl. Ind. III. 342; Wight Icon. t. 329; Hf. Ind. Fl. II. 228.

HAB. Not unfrequent in the open forests, especially the low and eng-forests, of Pegu; also Chittagong, Ava, and Tenasserim.—Fl. CS.

13. F. CAPITATA, Zoll. in Natuurk. en Geneesk. Arch. III. 64; Miq. Fl. Ind. Bat. I/2. 166. (*F. involucrata*, Bth. in Pl. Jungh. I. 246; Hf. Ind. Fl. II. 229; *Lepidocoma trifoliatum*, Jungh. in Topogr. Naturw. Reise, Java, 338 and in Flora 1847. 508.)

HAB. Frequent in the open, especially the low forests, all over Pegu; also in Martaban, where it ascends into the drier hill-forests; Upper Tenasserim.—Fl. Fr. CS.

F. procumbens of the Kew Herbarium, from Concan (Stocks; Wight No. 806), has nothing to do with Roxburgh's plant and appears to me to be a new species of *Lepidocoma*, probably connecting that genus with *Rhynchosioides*.

*14. F. VESTITA, Bth. in Hf. Ind. Fl. II. 230. (*Dolichos vestitus*, Grah. in Wall. Cat. 5545; *Rhynchosia vestita*, Bth. MS.).

HAB. Sometimes cultivated by the Karens of the Martaban Hills, at 3000 to 5000 feet elevation.

Eriosema, DC.

1. E. TUBEROSUM, (*Crotalaria tuberosa*, Ham. in Don Prod. Nap. 241; DC. Prod. II. 129; *E. Chinense*, Vog. in Pl. Meyen. 31; Bth. Fl. Austr. II. 268; Hf. Ind. Fl. II. 219).

HAB. Frequent in the open, especially the eng-forests, all over Prome and Pegu; also Martaban, here ascending into the drier hill-forests up to 4000 feet elevation.—Fl. Close of RS.; Fr. CS.

Crotalaria, L.

Conspectus of Species.

A. SIMPLICIFOLIÆ. Leaves simple.

* *Ovary and pods glabrous.*

+ Racemes lateral and leaf-opposed.

× Stipules none or small, not decurrent.

O Almost glabrous. Slender erect annuals.

Stipules half-lunate, persistent, ... *C. filiformis.*

Stipules very minute, deciduous, ... *C. Stocksii.*

O O Silk-hairy or pilose.

† Prostrate or ascending small herbs; flowers not above $2\frac{1}{2}$ lin. long.

Bracts subulate, very minute; stipules none; pods 15—30-seeded, ... *C. prostrata.*

Bracts subulate, minute; stipules minute, subulate; pods 6—8-seeded, .. *C. humifusa.*

Bracts lanceolate, a line long; stipules subulate, minute; pods 12—15-seeded, .. *C. acicularis.*

† † Flowers $\frac{1}{2}$—$\frac{3}{4}$ in. long. Erect branched annuals.

Tawny pilose; stipules lanceolate, spreading; pod 20—30-seeded, ... *C. ferruginea.*

× × Stipules decurrent and forming leafy wings to the branches.

Erect annual; flowers middling-sized, yellow; pods stalked, ... *C. alata.*

+ + Racemes terminal or terminating axillary branchings. More or less hairy, hirsute or appressed silk-hairy, rarely glabrous.

O Calyx divided to the base into lobes, of which especially the 2 upper ones much enlarge in fruit.

† Pod exserted from the calyx.

Flowers $\frac{1}{4}$ in. long, pale yellow, racemose; bracts linear, very minute; pods $1\frac{1}{2}$—2 times longer than the calyx, $\frac{1}{2}$—$\frac{3}{4}$ in. long, ... *C. albida.*

† † Pod more or less included and shorter than the calyx. (*Calycinæ.*)

¶ Pod small, globular or ovoid-globose, sessile.

Small herb; racemes shortened and head-like .... *C. nana.*

Erect annual of several feet; racemes elongate, ... *C. linifolia.*

¶ ¶ Pods linear-oblong to oblong.

Δ Flowers yellow or pale yellow.

Flowers few, in short lax racemes; fruiting calyx covered with long coppery brown soft hairs; pods an inch long; bracts and bractlets large, lanceolate, .. *C. calycina.*

Flowers in dense heads; calyx and pod $\frac{1}{4}$ in. long; bracts and bractlets large, ovate, acuminate, ... *C. dubia.*

Flowers? yellow, capitate; calyx and pods $\frac{1}{4}$—$\frac{1}{2}$ in. long; bracts and bractlets linea, *C. Chinensis.*

△ △ Flowers blue.

Flowers in long racemes; bracts and bractlets long, setaceous; calyx $\frac{1}{4}$—$\frac{1}{2}$ in. long; pods $\frac{1}{2}$ in. long, ... *C. sessiliflora.*

O O Pods very much exserted from the calyx. Calyx-tube obliquely bell-shaped, the teeth rather short, barely enlarging in fruit.

¶ Bracts subulate, very minute. Flowers yellow.

△ Branches and branchlets woody, with medullary pith, terete.

Almost glabrous; leaves acute; racemes terminating axillary branchlets or reduced to axillary flower-clusters, ... *C. Kurzii.*

△ △ Branches herbaceous, fistulose, stout.

Calyx and underside of the blunt or acute leaves densely appressed silky; racemes all terminal, ... *C. Assamica.*

Thinly appressed silk-hairy; leaves retuse to blunt; racemes all terminal, ... *C. retusa.*

¶ ¶ Bracts ovate to ovate-lanceolate, up to 4 lin. long, reflexed.

Glabrous; leaves blunt to acute, almost sessile, glaucous-green; pods stalked; branches stout, fistulose, ... *C. sericea.*

* * *Ovary variously clothed, from villose to tomentose and appressed silk-hairy. Pods similarly clothed, rarely minutely pubescent and appearing glabrous to the naked eye. (Flowers racemose.)*

+ Stipules none, or small and subulate. Flowers yellow.

× Pods minutely appressed-pubescent, appearing glabrous to the naked eye. Calyx glabrous. Leaves narrow.

Glabrous; bracts linear, very minute; leaves narrow-linear, ... *C. neriifolia.*

× × Pods and calyx brown or dark brown tomentose or pubescent, leaves narrow.

Stems sulcate, but not angular; pods sessile, 1—$1\frac{1}{4}$ in. long, ... *C. juncea.*

Stems sharply 4-angular; pods shortly stalked, $1\frac{1}{2}$—2 in. long, ... *C. tetragona.*

+ + Stipules large, leafy, half-lunate. Flowers blue or rarely greenish white.

Stems angular, more or less puberulous to glabrous; leaves rhomboid; pods pubescent, .. *C. verrucosa.*

B. Foliolatæ. Leaves 3—7-foliolate.

* *Leaves digitately 5 (occasionally 3)—7-foliolate.*

Leaves 5-foliolate; flowers rather large, yellow, racemose; bracts 3—4 lin. long, linear, acuminate, reflexed; pods glabrous, stalked, $1\frac{1}{4}$—$1\frac{1}{2}$ in. long, ... *C. quinquefolia.*

* * *Leaves digitately 3-foliolate.*

× Pods inflated.

+ Pods short, globular or obliquely ovoid, 1-2-4-seeded.

Stipules and bracts minute, subulate; flowers small, by 1—2 (rarely 3—4) terminating slender leaf-opposed peduncles; pods acuminate, minutely appressed pubescent, 1—2-seeded, ... *C. medicaginea.*

+ + Pods oblong to linear-oblong, many-seeded.

Pods indistinctly appressed-pubescent, linear-oblong, 1—$1\frac{1}{4}$ in. long, ... *C. striata.*

Pods densely tawny-villous, boat-shaped-oblong, somewhat curved, $\frac{2}{3}$—$\frac{3}{4}$ in. long, .. *C. bracteata.*

× × Pods much compressed (*Priotropis*, WA.).

Habit of *C. striata;* flowers yellow, racemose; pods 1 in. long by ½ broad, acuminate at both ends, on a filiform stalk, glabrous, ... *C. cytisoides.*

1. C. FILIFORMIS, Wall. Cat. 5389; Hf. Ind. Fl. II. 66.

HAB. Frequent in the mixed forests, especially the upper ones, of the Pegu Yomah, and along choungs in the lower mixed forests of the plains; also Prome district.—Fl. Fr. Nov. to Jan.

2. C. STOCKSII, Bth. MS.; Hf. Ind. Fl. II. 67.

HAB. Tenasserim (or Andamans?) (Helf.).

Unknown to me and included on Baker's authority.

3. C. PROSTRATA, Roxb. Fl. Ind. III. 270; Mart. Muench. Denkschr. 6. t. E; Hf. Ind. Fl. II. 67.

HAB. Martaban, Nattoung hills, east of Tounghoo (Revd. F. Mason).

4. C. ACICULARIS, Ham. ap. Bth. in Hook. Lond. Journ. Bot. II. 476; Hf. Ind. Fl. II. 68.

HAB. Common, chiefly in the dry and open forests, preferring stiff diluvial soils, all over Chittagong and Prome to Pegu and Martaban.—Fl. Fr. C. and HS.

5. C. FERRUGINEA, Grah. in Wall. Cat. 5398; Hf. Ind. Fl. II. 68.

Var. α. GENUINA (*C. ferruginea*, var. β. *pilosissima*, Bth. in Hf. Ind. Fl. II. 68), more or less spreading; leaves narrower and more or less acute; all parts more densely rusty pilose.

Var. β. PILOSISSIMA (*C. pilosissima*, Miq. Fl. Ind. Bat. I 327), erect and often less pilose; leaves broader and rounded or blunt at the apex.

HAB. Var. α. frequent in the drier hill- and the pine-forests of Martaban and Ava, at 4000 to 5000 ft. elevation; var. β. frequent along rocky river-beds in the tropical forests, from Ava and Martaban down to Tenasserim.—Fl. Fr. HS.

6. C. ALATA, Roxb. Hort. Bengh. 98. and Fl. Ind. III. 274; Hf. Ind. Fl. II. 69. (*C. bialata*, Roxb. Fl. Ind. III. 274).

HAB. Common in the long-grassed jungle-pastures of the open and dry forests, but also in the mixed forests, etc., all over Burmah, from Chittagong and Ava down to Pegu and Martaban.—Fl. Fr. Close of RS., and CS.

7. C. ALBIDA, Heyne in Roth. Nov. sp. 333; Hf. Ind. Fl. II. 71. (*C. montana*, Roxb. Fl. Ind. III. 265).

HAB. Frequent in the open and dry forests, all over Burma, from Chittagong and Ava down to Tenasserim.—Fl. Fr. CS.

8. C. LINIFOLIA, L. f. Suppl. 322; Roxb. Fl. Ind. III. 266; Hf. Ind. Fl. II. 72. (*C. cæspitosa*, Roxb. Fl. Ind. III. 269; *C. melanocarpa*, Bth. in Hook. Lond. Journ. II. 569).

HAB. Not unfrequent in the mixed forests, especially the upper ones, from Ava and Prome down to Pegu and Martaban; also found in

grass-lands and along grassy borders of the fields in the Pegu plains.—Fl. Fr. CS.

N. B. *C. patula*, Grah. (in Wall. Cat. 5371; Bth. in Hook. Lond. Journ. II. 568, from Ava), is reduced by Baker to a variety of *C. nana*, Burm. I am unacquainted with the species.

9. C. CALYCINA, Schrank. Pl. rar. Monac. t. 12; Hf. Ind. Fl. II. 72. (*C. stricta*, Roxb. Fl. Ind. III. 265, non Roth.).

HAB. Ava, Irrawaddi-valley near Tagoung (J. Anderson); Taong-dong (Wall.).—Fl. Fr. Jan.

10. C. DUBIA, Grah. in Wall. Cat. 5404; Hf. Ind. Fl. II. 73.

HAB. Frequent in the upper mixed forests, but chiefly in poonzohs, of Chittagong, Pegu, and Martaban, up to 3000 feet elevation.—Fl. Fr. CS.

11. C. CHINENSIS, L. sp. pl. 1003, non Roxb.; Hf. Ind. Fl. II. 73. (*C. barbata*, Miq. Fl. Ind. Bat. I. 338, *non* Grah.).

HAB. Pegu and Tenasserim (*teste* Baker).

12. C. SESSILIFLORA, L. sp. pl. 1004; Hf. Ind. Fl. II. 73.

HAB. Common in jungle-pastures and in open places of the open and dry forests, all over Burma, from Chittagong and Ava down to Tenasserim. Fl. Fr. Close of R. and CS.

13. C. KURZII, Bak. in Journ. As. Soc. Beng. 1873. 229; Hf. Ind. Fl. II. 75.

Var. *α.* GENUINA, Leaves longer and of a thinner texture; flowers usually axillary and gradually passing into terminal or axillary racemes with all intermediate conditions on the same plant; pods an inch long. Low-level form.

Var. *β.* MONTANA, leaves of a firmer texture and half the size; flowers in true leafless elongate axillary and terminal racemes; pods only ½ an inch long. High-level form.

HAB. Var. *α.* common in the upper, rare in the lower mixed forests, all over the Pegu Yomah and Martaban; var. *β.* pretty frequent in the drier hill- (especially the pine-) forests of Martaban, up to 5000 feet elevation.—Fl. CS.; Fr. HS.

C. Peguana, Bth. MS. (Hf. Ind. Fl. II. 77, from Rangoon), is unknown to me. It seems to me to differ in no respect from the axillary-flowered form of the above.

14. C. ASSAMICA, Bth. in Hook. Lond. Journ. Bot. II. 481; Hf. Ind. Fl. II. 75.

HAB. Ava, in the Khakyen hills, east of Bhamo (J. Anderson).—Fl. Fr. March.

In Ava specimens the flowers sometimes grow indifferently in the place of the leaves from the leaf-branches, so that the flowers are either mixed up with the leaves (reduced flowering branchlets) or form incomplete ra-

cemes below the leafy summit. The species itself, however, may be nothing but a more pubescent hill-form of *C. retusa.*

14. C. MACROPHYLLA, Kurz MS. (*C. Kurzii*, var. *luxurians*, Kurz in Journ. As. Soc. Beng. 1873, 229).

HAB. Rare in the moister upper mixed forests of the Southern Pegu Yomah.—Fr. CS.

I have referred this form erroneously to *C. Kurzii*, but the stout hollow stems bring it nearer to *C. Assamica*, from which it differs not only in its much larger petioled leaves and in the calyx, but also in the pods, which are sessile and 1½—2 in. long. Habitually it may be called a very luxuriant terminal-racemed form of *C. Kurzii.*

15. C. RETUSA, L. sp. pl. 1004; Roxb. Fl. Ind. III. 272; Bot. Mag. t. 2561; Bot. Reg. t. 253; Hf. Ind. Fl. II. 75.

HAB. Chiefly in grassy sandy places near the sea in Arracan and Pegu, but also found along the banks of the Irrawaddi in the Prome district; it has become a weed on Ross Island etc., on the Andamans, but there very likely only introduced.—Fl. Fr. Close of RS. and DS.

16. C. SERICEA, Retz. Obs. III. 26; Roxb. Fl. Ind. III. 273; Hf. Ind. Fl. II. 75.

HAB. Frequent along rocky choungs in the hills of Chittagong, Arracan, and the Pegu Yomah; rarely seen along the banks of the larger rivers in the plains of Pegu.—Fl. Fr. CS.

17. C. NERIIFOLIA, Wall. Cat. 5362; Hf. Ind. Fl. II. 74.

HAB. Not unfrequent in the hill-eng-forests of Martaban, east of Tounghoo; Ava, Taong-dong (Wall.).—Fl. Nov.; Fr. March, Apr.

18. C. JUNCEA, L. sp. pl. 1004; Bot. Mag. t. 490; Roxb. Corom. Pl. II. t. 193 and Fl. Ind. III. 259; Hf. Ind. Fl. II. 79. (*C. fenestrata*, Sims. Bot. Mag. t. 1933; *C. tenuifolia*, Roxb. Fl. Ind. III. 263).

HAB. Frequently cultivated in fields all over Burma, especially in Prome and Pegu, but also like wild along the banks of the larger rivers, especially the Irrawaddi.—Fl. Fr. H. and RS.

19. C. TETRAGONA, Roxb. Fl. Ind. III. 263; Andr. Bot. Repos. t. 593; Hf. Ind. Fl. II. 78. (*C. grandiflora*, Zoll. in Miq. Fl. Ind. Bat. I. 333, *teste* Baker).

HAB. Frequent, especially along rocky choungs in hilly tracts, all over Ava and Chittagong to Pegu and Arracan; ascending to 3000 feet elevation; less frequent along rivers in the alluvium of the plains.—Fl. Fr. CS.

20. C. VERRUCOSA, L. sp. pl. 1005; Roxb. Fl. Ind. III. 273; Bot. Mag. t. 3034; Bot. Reg. t. 1134; Wight Icon. t. 200; Hf. Ind. Fl. II. 77. (*C. angulosa*, Lamk. Enc. II. 196?; Roxb. Fl. Ind. III. 274; *C. coerulea*, Jacq. Icon. t. 144).

HAB. Frequent in open grassy places, along river-banks and road-sides, especially in Ava and Prome, less frequent in Pegu and Martaban.—Fl. Fr. C. and H. S.

21. C. QUINQUEFOLIA, L. sp. pl. 1006 ; Roxb. Fl. Ind. III. 279 ; Hf. Ind. Fl. II. 84 (*C. sp.* Griff. Not. Dicot. 437).

HAB. Not unfrequent in wet pastures, marshy grass-lands and along borders of rice-fields, from Arracan and Pegu down to Tenasserim.—Fl. Fr. RS.

22. C. MEDICAGINEA, Lamk. Dict. II. 201 ; Hf. Ind. Fl. II. 81 (*C. procumbens*, Roxb. Fl. Ind. 278).

HAB. Not unfrequent in the dry forests of Ava and Prome ; rare in the mixed forests of Pegu.—Fl. Close of RS ; Fr. CS.

23. C. BRACTEATA, Roxb. Fl. Ind. III. 278 ; Wight Icon. t. 273 ; Griff. Not. Dicot. 436 ; Hf. Ind. Fl. II. 83.

HAB. Not unfrequent in the mixed forests, especially the upper ones, and in dry pastures and rubbishy places adjoining them, all over Burma, from Chittagong and Ava down to Tenasserim.—Fl. Fr. Close of RS. and CS.

24. C. STRIATA, DC. Prod. II. 131 ; Bot. Mag. t. 3200 ; Hf. Ind. Fl. II. 85. (*C. Brownei* Rchb. Icon. Exot. t. 232 ; *C. Saltiana*, Andr. Bot. Repos. t. 648).

HAB. Frequent in grass and cleared lands, rubbishy places, along road-sides, etc., all over Pegu and Chittagong to Arracan ; most probably throughout the country.—Fl. Fr. R. and CS.

25. C. CYTISOIDES, Roxb. Fl. Ind. III. 276 (*Priotropis cytisoides*, WA. Prod. I. 180 in adn. ; Hf. Ind. Fl. II. 65).

HAB. Ava, Taong-dong, Khakhyen hills, east of Bhamo ; also Tenasserim (Griff.)—Fl. F. R. and CS.

Parochetus, Ham.

1. P. COMMUNIS, Ham. in Don. Prod. Fl. Nep. 240 ; Royle Ill. Him. Pl. t. 35 ; Hf. Ind. Fl. II. 86. (*P. major*, Don. Fl. Nep. 241 ; Wight Icon. t. 483 ; *P. maculatus*, R. Br. in Benn. Pl. Jav. rar. 162. t. 34 ; *Cosmiusa repens*, Alef. in Bot. Ztg. 1866. 145. t. 6. B. f. 1—6).

HAB. Ava and Tenasserim (*teste* Baker).

Melilotus, Juss.

1. M. ALBA, Desr. in Lamk. Dict. IV. 64 ; Koch Syn. Fl. Germ. ed. 3. I. 144 ; Hf. Ind. Fl. II. 89. (*M. leucantha*, Koch in DC. Fl. Franc. V. 564 ; Engl. Bot. Suppl. t. 2689 ; *Trifolium Indicum*, Willd. sp. pl. III. 1353 ; Roxb.—Fl. Ind. III. 388).

HAB. Prome district, a weed in the fields of the Irrawadi valley.—Fl. Fr. CS.

Psoralea, L.

1. P. CORYLIFOLIA, L. sp. pl. 1075; Roxb. Fl. Ind. III. 387; Bot. Mag. t. 665; Hf. Ind. Fl. II. 103. (*Melilotus* sp. Griff. Not. Dicot. 437. t. 578).

HAB. Occasionally in neglected fields, near hedges and along road-sides in the Prome district; apparently more frequent in Ava.—Fl. Fr. CS.

Cyamopsis, DC.

*1. C. PSORALIOIDES, DC. Prod. II. 216; Wight Icon. t. 248; Hf. Ind. Fl. II. 92. (*Dolichos fabæformis*, L' Her. Stirp. t. 78; Roxb. Fl. Ind. III. 316; *Lupinus trifoliatus*, Cav. Icon. t. 59).

HAB. Burma, cultivated (according to Revd. F. Mason).—Fl. Fr. CS.

Indigofera, L.

Conspectus of Species.

Subg. 1. *Sphæridiophora*, Desv. Ovary 1-ovuled. Pods very short, 1-seeded.

All parts, also the pods, appressed silk-hairy; leaves simple, small; pods almost globular, ... *I. linifolia.*

Subg. 2. *Eu-Indigofera*, Bth. Ovary 2—more-ovuled; pods usually elongate, rarely short.

* *Calyx deeply cleft, the lobes subulate-acuminate. Corolla about twice so long as the calyx. Annuals or perennials.*

+ Pods short, 2- rarely 3-seeded.

Appressed pubescent; leaves pinnate; pods almost 4-angular, shortly hairy; seeds cubical, ... *I. enneaphylla.*

+ + Pods many- or several-seeded, elongate.

O Seeds cylindrical.

Leaflets usually in 4 to 5 pairs; racemes shorter than the leaves, ... *I. tinctoria.*

Leaflets in 1 or 2 pairs; racemes very slender, much longer than the leaves, .. *I. endecaphylla.*

Leaves 3-foliolate; racemes very short or reduced to clusters, ... *I. trifoliata.*

O O Seeds cubical or 4-angular-oblong.

All parts (also the pods) viscose-pubescent; leaflets in 4—7 pairs, ... *I. viscosa.*

All parts appressed greyish or silvery pubescent; leaves 3-foliolate; pods thinly appressed pubescent, ... *I. trita.*

All parts hirsute-pubescent; leaflets usually in 3 or 4 pairs; pods hirsute, ... *I. hirsuta.*

* * *Calyx toothed, the teeth short, more or less acute. Corolla at least 3 times as long as the calyx and usually much longer. More or less woody shrubs.*

× Leaves simple or 3-foliolate (often on the same plant).

Whole plant greyish from minute appressed stiff hairs; leaves 1—3-foliolate on the same plant; stipules very minute, ... *I. Brunoniana.*

Softly tawny pubescent; leaves 1-foliolate; stipules about 2 lin. long, ... *I. caloneura.*

× × Leaves unpaired pinnate.

O Pods $1\frac{1}{2}$—2 in. long, more or less 4-gonous; seeds cubical or 4-cornered.

Stipules 2—3 lin. long; pods minutely appressed pubescent, ... *I. galegoides.*
Stipules minute; pods glabrous, ... *I. pulchella.*

O O Pods about an inch long, terete. Seeds cylindrical.

Pods glabrous; stipules minute, ... *I. elliptica.*

1. I. LINIFOLIA, Retz. Obs. IV. 29. and VI. 33. t. 2; Roxb. Corom. Pl. II. t. 196 and Fl. Ind. III. 370; Wight Icon. t. 313; Hf. Ind. Fl. II. 92.

HAB. Not unfrequent in short-grassed rather dry pastures of Chittagong, Pegu, and Arracan; probably all over the country.—Fl. Fr. chiefly C. and HS.

2. I. ENNEAPHYLLA, L. Mant. 272; Roxb. Fl. Ind. III. 376; Wight Icon. t. 403; Hf. Ind. Fl. II. 94.

HAB. Ava, on limestone hills about Segain; in the dry forests of the Prome district.—Fl. Fr. Nov.

3. I. TINCTORIA, L. sp. pl. 1061; Roxb. Fl. Ind. III. 379; Wight Icon. t. 365; Royle Ill. Him. Pl. t. 195; Hf. Ind. Fl. II. 99.

Var. *α.* GENUINA, pods about an inch long and more slender, usually straight or only slightly curved, 7—10-seeded, the seeds about a line long, pale coloured.

Var. *β.* ANIL (*J. Anil*, L. Mant. 272; Miq. Fl. Ind. Bat. I. 307; *J. coerulea*, Roxb. Fl. Ind. III. 377; Wight Icon. t. 366; *I. argentea*, var. *coerulea*, Bak. in Hf. Ind. Fl. II. 99), pods more curved and reflexed, shorter, about $\frac{1}{2}$ in. long but sometimes longer, 3—4, but as often 4—6 and even up to 7-seeded, the seeds smaller, olive-coloured.

HAB. Var. *α.* frequently cultivated in the Irrawaddi alluvium of Prome and Pegu, and most probably elsewhere; var. *β.* frequent in the open forests, especially the low ones, in jungle-pastures and along river-banks, all over Burma, from Ava and Martaban down to Tenasserim.—Fl. Fr. Close of RS., and CS.

I cannot find any sufficient grounds for specifically separating the above two forms; the pod differs greatly on the same plant.

4. I. ENDECAPHYLLA, Jacq. Icon. t. 570; Bot. Reg. t. 789; Hf. Ind. Fl. II. 98. (*I. debilis*, Grah. in Wall. Cat. 5466; Kurz in Journ. As. Soc. Beng. 1874, 184).

HAB. Ava, Irrawaddi valley (Wall.; Mrs. Burney).—Fl. Sept.

The pods of the Burmese plant are more slender and more persistently pubescent.

5. I. TRIFOLIATA, L. Amoen. IV. 327; Wight Icon. t. 314; Hf. Ind Fl. II. 96.

HAB. Tenasserim (Helf.) *teste* Baker.

6. I. VISCOSA, Lamk. Encycl. Meth. III. 247; Roxb. Fl. Ind. III. 377; Wight Icon. t. 404; Hf. Ind. Fl. II. 95.

HAB. Ava, near Mandalay (J. Anderson).—Fl. Fr. Sept.

7. I. TRITA, L. f. Suppl. 335; Roxb. Fl. Ind. III. 371; Wight. Icon. t. 315 and t. 386; Hook. Comp. Bot. Mag. I t. 16; Hf. Ind. Fl. II. 96. (*I. cinerea*, Willd. sp. pl. III. 1225; Roxb. l. c. 372).

HAB. Ava, Taong dong (Wall.).—Fr. Octob.

8. I. HIRSUTA, L. sp. pl. 1862; Roxb. Fl. Ind. III. 376; Jacq. Icon. t. 569; P. d. B. Fl. d' Ovar. t. 119; Hook. Comp. Bot. Mag. t. 24; Hf. Ind. Fl. II. 98.

HAB. Ava (Wall.); Tenasserim (*teste* Baker).—Fl. Octob.

9. I. BRUNONIANA, Grah. in Wall. Cat. 5491; Wall. Pl. As. rar. III. 48. t. 279; Hf. Ind. Fl. II. 93.

HAB. Not unfrequent in the eng-forests of the Prome district and of Pegu.—Fl. Close of RS.; Fr. CS.

10. I. CALONEURA, Kurz in Journ. As. Soc. Beng. 1873, 219; Hf. Ind. Fl. II. 93.

HAB. Pegu (Brandis), probably a laterite plant.

11. I. GALEGOIDES, DC. Prod. II. 225; Miq. Fl. Ind. Bat. I. 310; Hf. Ind. Fl. II. 100. (*I. uncinata*, Roxb. Fl. Ind. III. 382; *I. Zollingeriana*, Miq. Fl. Ind. I. 310? *teste* Baker).

HAB. Not unfrequent in the open, and more especially in the hill-eng-forests, of Martaban down to Tenasserim, up to 4000 feet elevation; also Pegu, Rangoon (Wall.).—Fl. RS.; Fr. CS.

12. I. PULCHELLA, Roxb. Fl. Ind. III. 382; Wight Icon. t. 367; Bedd. Fl. Sylv. 85. Anal. t. 12. f. 1.; Hf. Ind. Fl. II. 101, in part only. (*I. purpurascens*, Roxb. Fl. Ind. III. 383? *I. arborea*, Roxb. l. c. 318; Wight Icon. t. 368.)

HAB. Not unfrequent in the dry and open (chiefly the eng-) forests from Ava and Prome down to Pegu and Martaban.—Fl. Fr. C. and HS.

N. B. I. VIOLACEA, Roxb. l. c. 380, differs from the above in the pod and the cylindrically oblong pale-coloured seeds. It is in my eyes nearer akin to *I. elliptica*, from which it deviates only in the size and colour of the seeds.

13. I. ELLIPTICA, Roxb. Fl. Ind. III. 380.

HAB. Pegu, Rangoon (Cleghorn); Karen country (O'Riley); Tenasserim, Salween (Wall.).—Fr. CS.

Sesbania, Pers.

Conspectus of Species.

Subg. 1. *Agati*, Desv. Flowers 2—3 in. long, falcately recurved in bud, the standard acute or bluntish.

Small glabrous tree; flowers showy, white or scarlet, ... *S. grandiflora.*

Subg. 2. *Eu-Sesbania*, Bth. Flowers less than an inch long, straight in bud, yellow or brown-purple, the standard broad, more or less notched.

* *Racemes drooping from the base. Small trees.*

Glabrous; pods $1\frac{1}{2}$—2 lin. broad, somewhat angular from the prominent sutures, ..*S. Ægyptiaca.*

* * *Racemes erect from the base, but often overhanging. Shrubby annuals.*

Pods rather convex on both sides, $1\frac{1}{2}$—2 lin. broad; standard $\frac{1}{2}$ in. long; seeds cylindrical, ... *S. aculeata.*

Pods rather flat, 2—3 lin. broad, narrowly bordered; standard $\frac{2}{3}$ in. long, seeds more or less compressed-rhomboid, ... *S. Cochinchinensis.*

*1. S. GRANDIFLORA, Pers. Syn. II. 316; Bth. Fl. Austr. II. 212; Hf. Ind. Fl. II. 115. (*Agati grandiflora,* Desv. in Journ. Bot. III. 120; Griff. Not. Dicot. 438; *Æschynomene grandiflora,* Roxb. Fl. Ind. III. 331).

HAB. Only planted, but generally found in villages all over Burma.—Fl. RS.

*2. S. ÆGYPTIACA, Pers. Ench. II. 316; Wight Icon. t. 42; Bedd. Fl. Sylv. 86. Anal. t. 12. f. 3; Hf. Ind. Fl. II. 114. (*Æschynomene sesban,* L. sp. pl. 1061; Roxb. Fl. Ind. III. 332; *S. picta,* Pers., Bot. Mag. t. 873).

HAB. Generally planted in villages all over Burma.—Fl. Fr. Jan.—May.

3. S. ACULEATA, Pers. Enchir. II. 316; Hf. Ind. Fl. 115. (*Æschynomene spinulosa,* Roxb. Fl. Ind. III. 333; *S. polyphylla,* Miq. in Fl. Ind. Bat. I. 288; *Æschynomene cannabina,* Roxb. Fl. Ind. III. 335, *non* Pers.)

HAB. Rather frequent in long-grassed pastures and savannahs of the Kolodyne valley, Arracan.—Fl. Octob.

4. S. COCHINCHINENSIS, DC. Prod. II. 266; Miq. Fl. Ind. Bat. I. 287? (*Æschynomene paludosa,* Roxb. Fl. Ind. III. 333; *Sesbania cannabina,* Pers. Enchir. II. 316; WA. Prod. I. 215; *S. aculeata,* var. *cannabina,* Bak. in Hf. Ind. Fl. II. 115).

HAB. Not unfrequent in swamps and swampy pastures all over the plains of Pegu; also Chittagong.—Fl. Octob.; Fr. CS.

The Pegu plant is much smaller, and has the broad flat pod of this species and the habit and seeds of *S. aculeata,* but much fewer leaflets.

Tephrosia, Pers.

Conspectus of Species.

* *Flowers in axillary or leaf-opposed racemes, rarely reduced to* 2 *or a few only. Leaves unpaired-pinnate, rarely simple.*

× Calyx-teeth short, deltoid. (*Brissonia,* Neck.)

Shrub, silky pubescent; corolla $\frac{3}{4}$—1 in. long, white; racemes terminal and lateral; pod appressed silk-hairy, ... *T. candida.*

× × Calyx-teeth narrow, cuspidate, as long as the calyx-tube. Annuals or undershrubs. (*Reineria,* Mœnch.)

\+ Flowers in racemes.

O Racemes peduncled, leaf-opposed (and terminal).

Almost glabrous or very thinly appressed silk-hairy; pods glabrous or nearly so, .. *T. purpurea.*

O O Racemes axillary (and terminal), sometimes reduced.

Apparently similar to the preceding, but racemes short or reduced to a few (2) flowers only, ... *T. pauciflora.*

Racemes long-peduncled, many-flowered; leaves pinnate, leaflets in 3—6 pairs, appressed silvery silk-hairy; pods glabrescent, ... *T. tinctoria*

Racemes long-peduncled, many-flowered; leaves pinnate, leaflets in 6—9 pairs, thinly appressed silk-hairy; pods densely brownish silk-hairy, ... *T. Hookeriana.*

Racemes long-peduncled, few-flowered at the apex; leaves simple, or with a pair of diminutive basal leaflets; rest as in *T. tinctoria*, ... *T. Grahamii.*

+ + Flowers solitary or by pairs in the leaf-axils.

Silvery silk-hairy; leaflets in 2—3 pairs; pods appressed silvery pubescent, .. *T. senticosa.*

* * *Flowers solitary or paired in the leaf-axils, very small. Leaves simple.* (*Macronyx*, Dalz.).

All parts thinly silk-hairy; leaves linear; peduncle capillary, ... *T. tenuis.*

1. T. CANDIDA, DC. Prod. II. 249; Hf. Ind. Fl. II. 111. (*Kiesera sericea*, Rwdt. in Miq. Fl. Ind. Bat. I. 291).

HAB. Chittagong, Martaban and Tenasserim (*teste* Baker).

2. T. PURPUREA, Pers. Ench. II. 329; Hf. Ind. Fl. II. 112, in part. (*Galega purpurea*, L. sp. pl. 1063; Roxb. Fl. Ind. III. 386; *Galega lanceæfolia*, Roxb. l. c.).

HAB. Common in grassy lands, in shrubbery, along river- and road-sides, etc., also in savannahs, all over Burma, from Chittagong and Ava down to Tenasserim.—F. RS., Fr. CS.

2. T. PAUCIFLORA, Grah. in Wall. Cat. 5635; Hf. Ind. Fl. II. 114,

HAB. Ava, Paghamyo (Wall.)—Unknown to me.

3. T. TINCTORIA, Pers. Enchir. II, 329; Wight Icon. t. 388; Hf. Ind. Fl. II. 111. (*Galega tinctoria*, L. sp. pl. 1063; Roxb. Fl. Ind. III. 386; *Galega Heyneana*, Roxb. l. c. 384).

Var. α. GENUINA, the indument more or less tawny; leaflets oblong to elliptically oblong.

Var. β. COCCINEA, Bak. in Hf. Ind. Fl. II. 112. (*T. coccinea*, Wall. Pl. As. rar. t. 60), the indument silvery white; leaflets short and more or less obovate, the base usually cuneate.

HAB. VAR. β. only, Ava, along the banks of the Irawaddi, apparently common.—Fl. Fr. RS.

4. T. GRAHAMII, Wall. Cat. 5652 (*T. tinctoria*, var. *Grahamii*, WA. Prod. I. 211).

HAB. Rather frequent in the eng-forests of the Prome District.—Fl. RS.; Fr. CS.

5. T. SENTICOSA, Pers. Syr. II. 330; Wight Icon. t. 370; Hf. Ind.

Fl. II. 112. (*Galega senticosa*, L. Amoen III. 19; *Galega pentaphylla*, Roxb. Fl. Ind. III. 384).

HAB. Ava, Yenang-choung (Wall.) *teste* Baker.

6. T. TENUIS, Wall. Cat. 5970; Hook. in Journ. Bot. II. 35 in adn.; Hf. Ind. Fl. II. 111.

HAB. Ava, Segain, limestone-hills (Wall.).—Fr. Nov.

Millettia, WA.

Conspectus of Species.

Subg. 1. *Notho-Millettia*, Miq. Stamens diadelphous (9 + 1 and 7 + 1). Seeds usually not compressed.—Trees.

Glabrous; corolla purple, glabrous; stamens 9 + 1; pods coriaceous, the valves very convex and smooth, ... *M. atropurpurea.*

Subg. 2. *Eu-Millettia*, Bak. Stamens monadelphous, the 10th vexillary stamen more or less free at the base only. Seeds much compressed.

* *Standard not auricled at the base.*

× Trees.

× Valves of pod without prominent ledges or wings on the margins, flat or slightly convex, glabrous or nearly so.

O Pod-valves not rough from warts or lentils.

Young parts and leaves beneath slightly pubescent; corolla glabrous, lilac; pods appressed puberulous, ... *M. pulchra.*

Young parts slightly pubescent; corolla pubescent, lilac; pods glabrous, *M Brandisiana,*

Leaves beneath sparingly appressed grey-hairy; corolla glabrous; pod obscurely "grey-canescent," .... *M. cana.*

O O Pod-valves rough from warts or lentils, glabrous.

Young shoots silky pubescent; corolla glabrous, white; pods thick, lenticellate-rough, ... *M. leucantha.*

Glabrous; corolla glabrous, blue; pod thick, warted, ... *M. ovalifolia.*

× × Valves of pod extended into prominent ledges or wings.

Young shoots slightly pubescent; leaflets bluntish acuminate; racemes almost glabrous; corolla steel-blue, glabrous; pods sharply edged, ... *M. glaucescens.*

As preceding, but racemes pubescent; corolla white, glabrous; pods unknown, .. *M. pubinervis.*

Shortly tomentose, especially while young; leaflets rounded at the apex; corolla pale blue, glabrous; pods with 4 waved marginal wings, ... *M. tetraptera.*

+ + Woody climbers.

× Corolla glabrous. Ovary more or less pubescent. Pod glabrous.

Young shoots and leaves beneath pubescent; calyx broader than deep; corolla white; pods fleshy coriaceous, torose, ... *M. pachycarpa.*

As preceding, but glabrescent; flowers much smaller, lilac; calyx longer than wide; pod unknown, ... *M. monticola.*

× × Corolla, at least the standard, velvety or silky pubescent outside.

Leaves glabrous; flowers racemose, in terminal panicles; pods torose, tawny velvety, ... *M. cinerea.*

Leaves appressed silvery or coppery silk-hairy beneath; flowers in lateral racemes; pods flat, not torose, brown-velvety, ... *M. sericea.*

Leaves glabrous; flowers in axillary short peduncled racemes; pods brown velvety, ..*M. coerulea.*

* * *Standard auricled at the base on both sides of the claw.*

× Corolla glabrous.

Young shoots rusty tomentose; corolla violet; ovary quite glabrous, ...*M. leiogyna.*

× × Corolla, at least the standard, velvety or silky pubescent outside.

O Leaflets blunt or apiculate, rarely shortly acuminate. Branches brown.

Flowers purple; racemes elongate, longer than the petiole; pods glabrous when fully ripe,..*M. extensa.*

Flowers white; racemes elongate, much longer than the petiole; pods tawny or brown tomentose even when fully ripe, ...*M. macrophylla.*

Flowers rose-coloured; racemes much shorter than the petiole; leaflets obtuse; pods tawny or brown tomentose,..*M. fruticosa.*

O O Leaflets glaucous beneath, long- and caudate-acuminate. Branches grey.

Low scandent shrub, almost glabrous; flowers,...............................*M. caudata.*

1. M. ATROPURPUREA, Bth. in Pl. Jungh. I. 249 in adn.; Hf. Ind. Fl. II. 108. (*Pongamia atropurpurea,* Wall. Pl. As. rar. I. 70. t. 78; *Pongamiæ sp.* Griff. Not. Dicot. 444).

HAB. Rather frequent in the tropical forests along the eastern and southern slopes of the Pegu Yomah and from Martaban down to Tenasserim.—Fl. Jan.—March; Fr. May, June.

M. paniculata, Miq. Fl. Suppl. Fl. Sumatr. 301, differs only in its larger and more flattened pods; the seeds in my specimens are not developed. Miquel ascribes to this species a very abnormal diadelphism, viz. 7 + 1. *M.* sp. No. 1. from Malacca in Hf. Ind. Fl. II. 110 is apparently the same. *Pongamia glandulosa,* Griff. Not. Dicot. 443, from Mergui, remains doubtful to me, the more so as Griffith says nothing of the stamens, while he describes 10 hypogynous glands (abortive stamens?) surrounding the ovary; he compares the tree to *M. atropurpurea.*

2. M. PULCHRA, Kurz in Journ. As. Soc. Beng. 1873. 69. sub 138 and Pegu Report A. 45; Hf. Ind. Fl. II. 104. (*Mundulea pulchra,* Bth. in Pl. Jungh. I. 248 in adn.).

HAB. Ava Hills (Griffith).

3. M. BRANDISIANA, Kurz in Journ. As. Soc. Beng. 1873, 69; Hf. Ind. Fl. II. 108.

HAB. Frequent in the upper mixed forests of the Pegu Yomah.—Fl. March—Apr.; Fr. Jan. Febr.

Closely allied to the preceding species.

4. M. CANA, Bth. in Hf. Ind. Fl. II. 105. (*Pongamia cana,* Grah. in Wall. Cat. 5903; Bth. in Pl. Jungh. 250 in adn.).

HAB. Ava, banks of the Irrawaddi at Yenang choung (Wall.).

I do not know what authority Baker has for calling this species a climber.

5. M. LEUCANTHA, Kurz in Journ. As. Soc. Beng. 1873, 68. (*M. pendula*, Bak. in Hf. Ind. Fl. II. 105; *Pongamia pendula*, Grah. in Wall. Cat. 5902; Bth. in Pl. Jungh. 250 in adn., nomen enigmaticum).

HAB. Frequent in the dry and open forests, less so in the upper mixed forests, all over Prome and the Pegu Yomah, up to 2000 ft. elevation.—Fl. March, Apr; Fr. Apr., May.

6. M. OVALIFOLIA, Kurz in Journ. As. Soc. Beng. 1873, 68, excl. syn. *teste* Baker; Hf. Ind. Fl. II. 107.

HAB. Not unfrequent in the dry forests of the Prome district, where it occasionally enters the savannah forests.—Fl. Fr. March, Apr.

7. M. GLAUCESCENS, Kurz in Journ. As. Soc. Beng. 1873, 67; Hf. Ind. Fl. II. 107.

HAB. Frequent in the tropical and moister upper mixed forests of the eastern slopes of the Pegu Yomah and of Martaban.—Fl. Apr., May; Fr. May, June.

8. M. PUBINERVIS, Kurz in Journ. As. Soc. Beng. 1873, 68; Hf. Ind. Fl. II. 106.

HAB. Martaban, rather rare in the upper mixed forests of Toukyeghat, east of Tounghoo.—Fl. Apr.

Very nearly allied to the preceding species, chiefly differing in its smaller and longer acuminate leaflets, and in the colour of the flowers and pubescence. The pods are still unknown.

9. M. TETRAPTERA, Kurz in Journ. As. Soc. Beng. 1873, 69; Hf. Ind. Fl. II. 106.

HAB. Not unfrequent in the dry forests of Prome and Ava.—Fl. Apr.

10. M. PACHYCARPA, Bth. in Pl. Jungh. I. 250; Hf. Ind. Fl. II. 106.

HAB. Ava, Khakyen Hills (J. Anderson).—Fl. Apr.

11. M. MONTICOLA, Kurz in Journ. As. Soc. Beng. 1873, 67; Hf. Ind. Fl. II. 106.

HAB. Martaban, in the stunted hill- and the pine-forests of the Nattoung hills, at 6500—7100 ft. elevation.—Fl. March.

N. B. Occurs also at Darjeeling, Sikkim, at 7000 ft. elevation (S. Gamble).

12. M. CINEREA, Bth. in Pl. Jungh. I. 249 in adn.; Hf. Ind. Fl. II. 106. (*Robinia paniculata*, Roxb. MS. Icon. XX. t. 151, No. 2543; *Pongamia heterocarpa*, Wall. ap. Voigt. Cat. Hort. Calc. 240).

HAB. Ava (Wall.); Chittagong.—Fl. May.

13. M. SERICEA, WA. Prod. I. 263 in adn.; Hf. Ind. Fl. II. 104. (*Pongamia sericea*, Vent. Malm. No. 28; DC. Prod. II. 416; *Dalbergia angustifolia*, Hassk. Pl. Jav. rar. 399, *teste* Baker).

HAB. Along choungs in the tropical forests of Martaban, east of Tounghoo.—Fl. May.

14. M. CŒRULEA, Bak. in Hf. Ind. Fl. II. 107.

HAB. Upper Tenasserim, at Phanoe (Wall.).—Unknown to me.

15. M. LEIOGYNA, Kurz in Journ. As. Soc. Beng. 1873, 67; Hf. Ind. Fl. II. 109.

HAB. Martaban, in an upper mixed forest at Nakawa choung, Toukyeghat east of Tounghoo.—Fl. Apr.

16. M. EXTENSA, Bth. in Hf. Ind. Fl. II. 109. (*Otosema extensa*, Bth. in Pl. Jungh. I. 249; Walp. Ann. IV. 580).

HAB. Frequent in the leaf-shedding forests up to 2000—3000 feet elevation, all over Burma, from Ava and Martaban down to Upper Tenasserim.—Fl. March, Apr.; Fr. CS.

A species not clearly distinct from *M. macrophylla* (*Otosema macrophylla*, Bth. in Pl. Jungh. I. 249; *Robinia macrophylla*, Roxb. Fl. Ind. III. 329; *M. auriculata*, Baker in Hf. Ind. Fl. II. 108), and probably only an Indo-Chinese form of it.

17. M. FRUTICOSA, Bth. in Hf. Ind. Fl. II. 109. (*Otosema fruticosa*, Bth. in Pl. Jungh. I. 249; *Robinia fruticosa*, Roxb. Fl. Ind. III. 328).

HAB. Pegu (*teste* Baker).

18. M. CAUDATA, Bak. in Hf. Ind. Fl. II. 109. (*Otosema caudata*. Bth. in Pl. Jungh. I. 249; *Tephrosia urophylla*, Wall. ap. Voigt. Hort, Calc. 216).

HAB. Martaban, creeping and twining in the rocky bed of the Toukyeghat river, east of Tounghoo.

I have leaf-specimens only. These have the leaflets broader than in the normal form, but in other respects they perfectly agree with the Assam plant.

Pongamia, Vent.

1. P. MITIS, (*Robinia mitis*, L. sp. pl. 1044; *P. glabra*, Vent. Hort. Malmais. I. t. 28; Wight Icon. t. 59; Bedd. Fl. Sylv. Madr. t. 177; Hf. Ind. Fl. II, 240; *Galedupa Indica*, Lamk. Encycl. Méth. II. 594; Roxb. Fl. Ind. III. 239).

HAB. Frequent in the tidal and beach-forests all along the coasts, from Chittagong down to Tenasserim and the Andamans.—Fl. Febr. March; Fr. RS.

Derris, Lour.

Conspectus of Species.

Subg. 1. *Brachypterum*, WA. (*Eu-Derris*, Bth.). Standard equally tapering at the base, with or without 2 basal callosities. Stamens monadelphous. Pods narrowly winged along the vexillary suture only.

* *Standard without basal callosities.*

× Flowers in simple or almost simple racemes.

+ Pods lanceolate, acuminate or acute at both ends.

Erect tree ; leaflets almost acute, mucronate, ...*D. robusta.*

Scandent shrub ; leaflets notched, ...*D scandens.*

+ + Pods oblong or orbicular, with rounded ends. Scandent shrubs.

All parts, also the pods, glabrous, ...*D. uliginosa.*

Rusty pubescent ; pods pubescent,..*D. elegans.*

× × Flowers racemose, collected into panicles.

Scandent, glabrous ; pods sinuately constricted between the seeds ; corolla $\frac{1}{2}$ in long, ..*D. sinuata.*

* * *Standard with 2 basal callosities (Paraderris,* Miq.)

Scandent, young shoots densely silk-hairy ; flowers 10 lin. long ; ovary villous, *D. elliptica.*

Subg. 2. *Aganope,* Miq. (*Dipteroderris,* Bth.) Standard equally narrowed at the base and without callosities. Stamens monadelphous, or the vexillary one free. Pods more or less distinctly winged at both sutures.

Scandent, glabrous ; lateral nerves beneath very faint, immersed, ...*D. amoena.*

1. D. ROBUSTA, Bth. in Linn. Proc. IV. Suppl. 104. *(Dalbergia robusta,* Roxb. Hort. Beng. 53 ; DC. Prod. II. 417 ; Wight Icon. t. 244 ; *Dalbergia Krowee,* Roxb. Fl. Ind. III. 229).

HAB. Not unfrequent in the upper and lower mixed forests of Pegu ; Ava ; also Andamans.—Fl. Apr.

2. D. SCANDENS, Bth. in Linn. Proc. IV. Suppl. 103 ; Hf. Ind. Fl. II. 240. *(Dalbergia scandens,* Roxb. Corom. Pl. II. t. 192 and Fl. Ind III. 232 ; *Brachypterum scandens,* WA. in Wight Icon. t. 275).

HAB. Frequent in the tidal and swamp-forests, but also entering the savannah-forests, of the alluvial lands, all over Burma, from Chittagong, Prome, and Martaban down to Tenasserim aud the Andamans.—Fl. Jun. Jul. ; Fr. CS.

3. D. ULIGINOSA, Bth. in Pl. Jungh. I. 252. and in Linn. Proc. IV. Suppl. 107. *(Pongamia uliginosa,* DC. Prod. II. 416 ; Hook. Bot. Misc. III. 301. suppl. t. 41 sub *P. religiosa* and *P. triphylla ; Galedupa uliginosa,* Roxb. Fl. Ind. III. 243).

HAB. Frequent in the tidal forests and in low littoral lands, from Arracan down to Tenasserim and the Andamans.—Fl. March, May ; Fr. RS.

4. D. ELEGANS, Bth. in Pl. Jungh. I. 252 in adn. and in Linn. Proc. IV. Suppl. 109.

HAB. In the swamp-forests of the Irrawadi in Pegu, and along marshy streams in Tenasserim as far south as Mergui.—Fl. Febr. March.

5. D. SINUATA, Thw. Ceyl. Pl. 93 ; Bth. in Linn. Proc. IV. Suppl. 113. (*D. polyarthra,* Miq. Suppl. Fl. Sumatr. 298).

HAB. Not unfrequent in the tidal forests and in the beach-jungles of Pegu and Tenasserim.—Fr. Nov. Decb.

6. D. ELLIPTICA, Bth. in Linn. Proc. IV. Suppl. III (*Pongamia elliptica*, Wall. Pl. As. rar. III. 20. t. 237; Wight Icon. t. 420; *Galedupa elliptica*, Roxb. Fl. Ind. III. 242; *Pongamia volubilis*, Zoll. and Mor. Syst. Verz. 3; *Pongamia Horsfieldii*, Miq. Fl. Ind. Bat. I. 149).

HAB. Upper Tenasserim, Attaran and Moulmein (Wall.).

7. D. AMOENA, Bth. in Pl. Jungh. I. 252 in adn. and in Linn. Proc. IV. Suppl. 110.

HAB. Tenasserim, Moulmein to Mergui.—Fr. March.

Pterocarpus, L.

Conspectus of Species.

Pods about an inch across, almost glabrous (even while young), the stylose point far above the base; calyx more glabrous, ... *P. Indicus.*

Pods almost 1½—2 in. in diameter, when young densely velvety-pubescent, the stylose point at the basal corner; calyx rusty pubescent, ... *P. macrocarpus.*

1. P. INDICUS, Willd. sp. pl. III. 904; Roxb. Fl. Ind. III. 238; Bedd. Fl. Sylv. t. 23; Hf. Ind. Fl. II. 238. (*P. flavus*, Lour. Fl. Cochinch. II. 525; Miq. Fl. Ind. Bat. I. 136; *P dalbergioides*, Roxb. Fl. Ind. III. 236; Wight Icon. t. 246).

HAB. Frequent in the tropical and the moister upper mixed forests, from Martaban down to Tenasserim and the Andamans; rare along the eastern slopes of the Pegu Yomah.—Fl. May, Jun.; Fr. Jul., Aug.

2. P. MACROCARPUS, Kurz in Journ. As. Soc. Beng. 1874, 187; Hf. Ind. Fl. II. 239.

HAB. Frequent in the eng- and the upper mixed forests, from Martaban down to Tenasserim; very rare in the dry forests of the Prome District.—Fl. Apr. May; Fr. RS.

There are, as the Rev. Dr. Mason remarks (Journ. As. Soc. Beng. 1848, 223 sqq.), two kinds of padouk in Burma, the "padouk nee" (red padouk) and the "padouk pyoo" (white padouk). I do not know whether these two varieties correspond to the two species here adopted.

Dalbergia, L.f.

Conspectus of Species.

Subg. 1. *Dalbergaria*, Bth. Stamens united into 2 separate sheaths of 5 each.

* *Erect trees.*

× Pods velvety.

Leaves bluntish acuminate; panicles lax, puberulous; flowers purple, ... *D. cana.*

× × Pods quite glabrous.

\+ Leaflets rather large, apiculate, acute or acuminate.

Leaflets retuse-apiculate; panicles lax, puberulous; flowers white or purplish, ..*D. purpurea.*

Leaflets acute or shortly acuminate; panicles short and compact; calyx glabrous; flowers white, ... *D. glomeriflora.*

\+ + Leaflets blunt or retuse, rather small.

Panicle rather compact; pedicels short or very short; leaves nigrescent, *D. nigrescens.*
Panicle lax; pedicels slender; flowers white or purplish outside; leaves not nigrescent, ...*D. paniculata.*

* * *Woody climbers. (Leaflets blunt or retuse).*

Leaflets 11—13; panicles densely pubescent; bractlets minute, ...*D. volubilis.*
Leaflets 17—21; panicles glabrous; bractlets small but conspicuous, ...*D. stipulacea.*

Subg. 2. *Sissoa*, Bth. Stamens united into a single slit sheath.

* *Erect trees. Flowers white.*

× Bractlets fallen long before expansion of the flowers.

Leaflets 3—7, almost orbicular to obovate, notched or blunt; all parts glabrous, ..*D. latifolia.*
Young shoots appressed silky puberulous; leaflets 7—11, more or less oblong, notched, or blunt, ...*D. cultrata.*

× × Bractlets black, short and broad, deciduous but still present at flowering time.

Leaflets blunt, more or less notched and mucronate, ...*D. glauca.*
Leaflets acuminate, smaller or more coriaceous, ...*D. ovata.*

* * *Woody climbers.*

× Leaflets in 5—7 pairs; inflorescence, etc., glabrous.

Flowers blue; panicle ample, terminal; leaflets more or less oblong, ...*D. foliacea.*
Flowers white; panicles small, axillary; leaflets more or less obovate, *D. rubiginosa.*

× × Leaflets in 11—41 pairs; inflorescence and young branchlets rusty pubescent.

Leaflets ⅓—½ in. long; panicles or cymes very short, ...*D. tamarindifolia.*
Leaflets 1—2 in. long; panicle ample, ...*D. velutina.*

1. D. CANA, Grah. in Wall. Cat. 5859; Kurz in Journ. As. Soc. Beng. 1873. 70; Hf. Ind. Fl. II. 237.

HAB. Not unfrequent in the tropical forests, especially along choungs, all along the eastern slopes of the Pegu Yomah, and from Martaban down to Upper Tenasserim.—Fl. March; Fr. CS.

2. D. PURPUREA, Wall. Cat. 5869; Bth. in Linn. Proc. IV. Suppl. 46 in part only; Hf. Ind. Fl. II. 235.

HAB. Frequent in all mixed forests from Pegu and Martaban down to Upper Tenasserim.—Fl. Febr. March; Fr. CS.

3. D. GLOMERIFLORA, Kurz in Journ. As. Soc. Beng. 1873, 70; Hf. Ind. Fl. II. 236.

HAB. Rare in the upper mixed forests of the Yomah in the Prome District, at 1000—2000 feet elevation.—Fl. March, Apr.

4. D. NIGRESCENS, Kurz in Pegu Rep. App. A. 48 and B. 45.

HAB. Frequent in the dry forests, especially the mixed ones, of Prome and Ava.

N. B. Occurs also in Hindustan, where (according to Dr. Brandis) it is a sacred tree. It is very near allied to the following, and in leaf and flowerless at the time when *D. paniculata* is leafless and in full bloom.

5. D. PANICULATA, Roxb. Corom. Pl. II. 8. t. 114 and Fl. Ind. III. 227; Hf. Ind. Fl. II. 236.

HAB. Rather frequent in the mixed dry forests of Ava and Prome, occasionally found also in the drier upper mixed forests of the Pegu Yomah.—Fl. March; Fr. May, June.

6. D. VOLUBILIS, Roxb. Corom. Pl. II. 48. t. 191. and Fl. Ind. III. 231; Hf. Ind. Fl. II. 235.

HAB. Frequent in the mixed forests, especially the lower ones, occasionally also in the savannahs, all over Chittagong, Ava, and Martaban down to Upper Tenasserim.—Fl. Febr., March; Fr. Apr., May.

7. D. STIPULACEA, Roxb. Fl. Ind. III. 233; Wight Icon. t. 243; Hf. Ind. Fl. II. 237. (*D. ferruginea*, Roxb. Fl. Ind. III. 228, *teste* Baker).

HAB. Common, not only in the mixed and tropical forests, but also ascending into the drier hill-forests, all over Pegu and Martaban down to Tenasserim, up to 3500 ft. elevation; also Chittagong.—Fl. Jan., Febr.; Fr. CS.

8. D. LATIFOLIA, Roxb. Corom. Pl. II. 7. t. 113, and Fl. Ind. III. 221; Wight Icon. t. 1156; Bedd. Fl. Sylv. t. 24; Hf. Ind. Fl. II. 231. (*D. emarginata*, Roxb. Fl. Ind. III. 224; *D. Javanica*, Miq. Fl. Ind. Bat. I. 132; Bth. in Linn. Proc. IV. Suppl. 38).

HAB. Andaman Islands (Roxburgh).

9. D. CULTRATA, Grah. in Wall. Cat. 5861; Hf. Ind. Fl. II. 233.

HAB. Common in all leaf-shedding forests, especially in the savannah- and eng-forests, all over Burma, from Ava and Martaban down to Upper Tenasserim.—Fl. March, Apr.; Fr. CS.

10. D. GLAUCA, Wall. Cat. 5862. (*D. ovata*, var. *obtusifolia*, Bak. in Hf. Ind. Fl. II. 231).

HAB. Not unfrequent in the upper mixed forests, from the Pegu Yomah and Martaban down to Upper Tenasserim; also Ava.—Fl. Jan., Febr.; Fr. March, May.

11. D. OVATA, Grah. in Wall. Cat. 5854; Bth. in Linn. Proc. IV. Suppl. 39; Hf. Ind. Fl. II. 231.

Var. *α*. GENUINA, quite glabrous.

Var. *β*. PUBERULA, leaflets beneath and panicles puberulous.

HAB. Not unfrequent in the upper mixed forests, especially along choungs, from the Pegu Yomah and the Martaban Hills down to Upper Tenasserim; var. *β*. Pegu, Irrawaddi district (Dr. Brandis).—Fl. Jan. Febr.; Fr. Apr, May.

12. D. FOLIACEA, Wall. Cat. 5856; Bth. in Linn. Proc. IV. Suppl. 41; Hf. Ind. Fl. II. 232.

HAB. Not unfrequent along choungs, in the upper mixed forests of the Pegu Yomah, and from Martaban down to Upper Tenasserim; also Ava. —Fl. Jan. Febr.; Fr. CS.

13. D. RUBIGINOSA, Roxb. Corom. Pl. II. 9. t. 115 and Pl. Ind. III. 231; Hf. Ind. II. 232.

HAB. Not unfrequent in the tropical forests around the Kambala toung, Pegu Yomah, probably on calcareous sandstone.

14. D. TAMARINDIFOLIA, Roxb. Hort. Bengh. 53 and Fl. Ind. III. 233; Wight Icon. t. 242; Hf. Ind. Fl. II. 234. (*Derris pinnata*, Lour. Fl. Coch. 432).

Hab. Not unfrequent in the forests of the Andamans; also Tenasserim.—Fl. May, June.

The pods of the Burmese species (=*D. rufa* and *multijuga*, Grah.) differ a good deal from those figured by Roxburgh, and they are much narrower. The pods of the Assam plant are unknown to me, but Mr. Simons calls it "a large tree 30 to 40 feet high." The matter requires further inquiry.

15. D. VELUTINA, Bth. in Pl Jungh. I. 255 in adn. and in Linn. Proc. IV. Suppl. 43; Hf. Ind. Fl. II. 233.

HAB. Frequent in the tropical forests, ascending into the hill-forests up to 4000 feet elevation, from Pegu and Martaban down to Tenasserim. —Fl. March.

Drepanocarpus, E. Mey.

Conspectus of Species.

Subg. 1. *Eu-Drepanocarpus.* Stamens united into a single sheath.

× Corolla glabrous. Pods usually 1-seeded. (*Selenolobium*, Bth.)

Leaflets ½ in. long; calyx a line long, ...*D. spinosus.*

Leaflets about an in. long; calyx 1½ lin. deep, ..*D. monospermus.*

× × Corolla pubescent outside. Pods usually 1-seeded. (American.)

Subg. 2. *Pongamiopsis.* Stamens united into 2 separate sheaths. Corolla glabrous. Pods 1—3-seeded, moniliform-constricted between the seeds.

Tree; panicles rusty villous; pod-joints smoothish, dimorphous, some flat and thick coriaceous, others very thick and fleshy, ..*D. reniformis.*

Arboreous climber; panicles almost glabrous; pod-joints flat and thick-coriaceous, wrinkled-veined, ..*D. Cumingii.*

1. D. SPINOSUS, (*Dalbergia spinosa*, Roxb. Fl. Ind. III. 233; Hf. Ind. Fl. II. 238)

HAB. Frequent in the tidal forests along the coasts from Chittagong down to Tenasserim.—Fl. May, June; Fr. CS.

This and the following are referred by Bentham to *Dalbergia*, but the pods are not winged and the cell-cavity extends from suture to suture. Strictly speaking the pods of *Dalbergia* cannot be called winged, for the broad thin margins of the pod are simply consolidated so as to leave (as in *Pterocarpus*) only a central cavity for the seed.

2. D. MONOSPERMUS, (*Dalbergia monosperma*, Dalz. in Kew. Journ. Bot. II. 36; Miq. Fl. Ind. Bat. I. 132. t. 3. f. D.; Hf. Ind. Fl. II. 237).

HAB. Tidal forests of Upper Tenasserim (Falconer).—Fl. March.

3. D. RENIFORMIS, Kurz in Pegu Rep. App. A. 49. and B. 45. (*Dalbergia reniformis*, Roxb. Fl. Ind. III. 226; Wight Icon. t. 261; Hf. Ind. Fl. II. 238; *Dalbergia flexuosa*, Grah. in Wall. Cat. 5875; Bth. in Linn. Proc. IV. Suppl. 48).

HAB. Frequent in the swamp-forests and around lakes and marshy grounds, especially in the alluvial lands, all over Pegu and Martaban down to Upper Tenasserim.—Fl. Febr. March; Fr. Apr.—June.

Curious on account of the joints being dimorphous on the same or on different pods. They are either normally thick-coriaceous and as flat as those of the following species, and have the seeds much compressed; or they are firmly fleshy and up to half inch thick, in which case the seeds are larger and scarcely compressed. This latter state is not attributable to the agency of insects, but seems to be normal development. The full-grown foliage so much resembles that of *Dep. inundatus*, Mart., that I should experience some difficulty in distinguishing between the two species when out of flower or fruit.

4. D. CUMINGII, (*Dalbergia Cumingii*, Bth. in Pl. Jungh. I. 255 in adn. and in Proc. Linu, Soc. IV. Suppl. 32; *D. Zollingeriana*, Miq. Fl. Ind. Bat. I. 130).

HAB. Tenasserim (or Andamans ?) (Helf. 1808.)

My plant is Miquel's *D. Zollingeriana*, which Bentham connects with the Philippine plant.

Cassia, L.

Conspectus of Species.

Subg. 1. *Fistula*, DC. Filaments of the 3 lower stamens very long and arcuate the others short or imperfect. Pod terete, elongate, indehiscent. Seeds horizontal.

* *Racemes slender and elongate, drooping, destitute of bracts. Flowers yellow.*

All adult parts glabrous; calyx very deciduous, velvety; petals about an inch long, .. *C. Fistula.*

* * *Racemes often corymb-like, more or less erect, with persistent bracts.* Flowers pale or intensely pink-coloured. (Longer filaments thickened node-like at middle).

Leaflets shortly acuminate, on petiolules 1—2 lin. long; bracts narrowly lanceolate, .. *C. nodosa.*

Leaflets retuse or blunt, pubescent, almost sessile; bracts cordate-ovate, ... *C. renigera.*

Subg. 2. *Senna.* Perfect anthers 7 or 10, opening by terminal pores or short slits. Pods opening along one or both sutures. Seeds transverse or oblique.

* *Pods usually not elastically opening. Funicle of seed filiform.* (*Senna genuina.*)

× Pods compressed and often flat, sometimes winged. (*Chamæsenna*).

\+ Perfect stamens 10 (*Psilorhegma*).

Leaflets bluntish or rounded, more or less glaucous beneath; flowers yellow, in corymb-like racemes; bracts small, persistent; pods black, very flat, shortly stalked, ...*C. glauca.*

+ + Perfect stamens 7. Pods much compressed. Flowers yellow.

O Pods not winged.

† Pods straight and acute. Trees or shrubs.

△ Stipules none or very deciduous. Trees. Petals ½ in. long.

Adult parts glabrous; bracts small, persistent, obovate with a subulate point longer than the blade; leaflets in 6—10 pairs, 1½—2 in. long; pods velvety, ... *C. Siamea.*

All parts pubescent; bracts leafy, broad-ovate, about ⅓ in. long; leaflets in 10—20 pairs, 1—1¼ in. long; pods glabrous, ... *C. Timoriensis.*

△ △ Stipules large, cordate-semilunate, persistent.

More or less pubescent; leaflets in 8—10 pairs, ½—¾ in. long; bracts ovate to obovate lanceolate, 3—4 lin. long; petals nearly an in. long; pods shortly and rather thinly pubescent, ... *C. auriculata.*

† † Pods lunate.

Glabrous perennial; calyx glabrous; petals 3—4 lin. long; pods shortly stalked, glabrous, ... *C. obovata.*

O O Pods broadly 4-winged. Flowers large, orange-yellow.

Shrubby herb, almost glabrous; leaves abruptly pinnate, the rachis almost winged-angular; bracts yellow, obovate-oblong, about an in. long, deciduous; pods glabrous, ... *C. alata.*

× × Pods more or less terete to 4-gonous. Seeds transverse, oblique or rarely parallel with the valves. (Herbs; flowers yellow).

+ Seeds transverse or oblique.

Leaves abruptly 4 pinnate, glabrous, leaflets in 4—12 pairs, acuminate; calyx glabrous; petals about ½ in. long; ovary glabrous, ... *C. occidentalis.*

+ + Seeds parallel with the valves.

Leaves abruptly pinnate, leaflets in 3—2 pairs, blunt; petals nearly ½ in. long; ovary shortly pubescent, ... *C. Tora.*

* * *Pods opening elastically at both sutures. Funicle very short. Perfect anthers* 10 *or fewer by abortion, opening by slits. Herbs; flowers yellow, small (Lasiorhegma).*

More or less prostrate; leaflets in 8—15 pairs, 2½—3½ lin. long; basal gland of rachis long-stalked; pedicels 1—2 lin. long, ... *C. pumila.*

Erect, branched; leaflets in 15—30 pairs, 1—3 lin. long; basal glands of rachis sessile; pedicels up to ½—¾ in. long, ... *C. mimosoides.*

1. C. Fistula, L. sp. pl. 440; WA. Prod. I. 285; Roxb. Fl. Ind. II. 333; Bth. in Linn. Trans. XXVII. 514. *(Cathartocarpus Fistula*, Pers. Syn. I. 459; Wight Icon. t. 269; *C. rhombifolia*, Roxb. Fl. Ind. II. 334*)*.

Hab. Frequent in the leaf-shedding forests, especially in the savannah and mixed ones, all over Burma and adjacent provinces.—Fl. Apr.; Fr. CS.

2. C. nodosa, Ham. in Roxb. Fl. Ind. II. 336; Wight Icon. t. 410; Bth. in Linn. Trans. XXVII. 517. *(Cathartocarpus nodosus,* Voigt Hort. Suburb. Calc. 248.)

Hab. Rather rare in the tropical forests of Martaban down to Upper Tenasserim; also Chittagong.—Fl. Apr.; Fr. CS.

3. C. RENIGERA, Wall. Cat. 5307; Bth. in Linn. Trans. XXVII. 518; Kurz in Journ. As. Soc. Beng. 1873. 71.

HAB. Not unfrequent in the dry forests of Prome and Ava; also Martaban? (Pounglouug hills above 2000 feet, Dr. Brandis).—Fl. Apr. Fr. Nov.

4. C. GLAUCA, Lamk. Dict. I. 647; Bth. in Linn. Trans. XXVII. 555. (*Senna arborescens*, Roxb. Fl. Ind. II. 345; *Senna speciosa*, Roxb. l. c. 347; *C. suffruticosa*, Koen. in Roth. Nov. sp. pl. 213).

Var. *α*. GENUINA, all parts more glabrous; leaflets larger, bluntish or acute, more glaucous beneath.

Var. *β*. KŒNIGII, (*C. fruticosa*, Koen. l. c.; *C. speciosa*, Roxb. l. c.) the young parts more pubescent; leaflets ½—1 in. only long, retuse or rounded, less glaucous beneath.

HAB. Var. *α*. not unfrequent in the dry forests of Ava and Prome, especially along the courses of rivers, var. *β*. only seen cultivated around khyoungs, etc., in Pegu.—Fl. Fr. ∞.

5. C. SIAMEA, Lamk. Dict. I. 648; Bth. in Linn. Trans. XXVII. 549. (*C. florida*, Vhl. Symb. III. 57; *C. Sumatrana*, Roxb. Hort. Beng. 31; DC. Prod. II. 506; *Senna Sumatrana*, Roxb. Fl. Ind. II. 347).

Var. *α*. GENUINA, leaves glabrous, the leaflets more glaucous beneath; a large tree.

Var. *β*. PUBERULA, rachis of leaves puberulous, leaflets puberulous (especially while young) but less glaucescent beneath; a low rather stunted tree.

HAB. Var. *α*. rather frequent in the mixed forests (chiefly the upper ones) from Chittagong and Ava down to Tenasserim; var. *β*. restricted to the forests of Ava and Prome.—Fl. Nov. Jan.; Fr. March, Apr.

6. C. TIMORIENSIS, DC. Prod. II. 499; Miq. Fl. Ind. Bat. I. 99; Bth. in Linn. Trans. XXVII. 550. (*C. palmata*, Wall. Cat. 5306; Walp. Rep. I. 827).

HAB. Frequent in the mixed and dry forests, but more especially along choungs in the upper mixed forests, all over Burma, from Ava down to Tenasserim.—Fl. Sept. Oct.; Fr. CS.

7. C. AURICULATA, L. sp. pl. 542; Bth. in Linn. Trans. XXVII. 547. (*Senna auriculata*, Roxb. Fl. Ind. II. 349).

HAB. Apparently frequent in the Irrawaddi valley of Ava.—Fl. Sept. —Febr.

8. C. OBOVATA, Collad. Hist. Cass. 92. t. 15; Bth. in Linn. Trans. XXVII. 553. (*Senna obtusa*, Roxb. Fl. Ind. II. 344; *Cassia obtusa*, Roxb. Hort. Bengh. 31; Wight Icon. t. 757).

HAB. Ava, Yenang-choung in the Irrawaddi valley (Wall.).

9. C. ALATA, L. sp. pl. 541; Wight Icon. t. 253; Bth. in Linn.

Trans. XXVII. 550; Griff. Not. Dicot. 448. (*Senna alata*, Roxb. Fl. Ind. II. 349).

HAB. Generally cultivated all over Burma, and often springing up in waste places and poonzohs; apparently wild in Tenasserim.—Fl. Nov. —Decb.; Fr. Febr.

10. C. OCCIDENTALIS, L. sp. pl. 539; Bot. Reg. t. 83; Bth. in Linn. Trans. XXVII. 532. (*Senna occidentalis*, Roxb. Fl. Ind. II. 343; *C. Sophera*, L. sp. pl. 542; Bth. l. c.; *Senna Sophera*, Roxb. l. c. 347).

HAB. Common in rubbishy places, along banks of rivers, in fallow fields and poonzohs, all over Burma and adjacent provinces.—Fl. Fr. ∞.

11. C. TORA, L. sp. pl. 538; Bth. in Linn. Trans. XXVII. 535. (*Senna Tora*, Roxb. Fl. Ind. II. 340; *Senna toroides*, Roxb. l. c. 341).

Var. *α*. GLABRA, all parts glabrous or nearly so.

Var. *β*. PUBESCENS, all parts appressedly (often greyish) pubescent.

HAB. Common, not only in the leaf-shedding forests, but also in waste places, along river-sides, on neglected culture-land, etc., all over Burma and the adjacent provinces; var. *β*. in similar places in the dry Prome district.—Fl. Fr. ∞.

12. C. PUMILA, Lamk. Dict. I. 651; Bth. in Linn. Trans. XXVII. 570. (*Senna prostrata*, Roxb. Fl. Ind. II. 352).

HAB. Prome district, in the dry forests.—Fl. Fr. Close of RS.

13. C. MIMOSOIDES, L. sp. pl. 543; Vog. in Linn. XI. 714; Bth. in Linn. Trans. XXVII. 579.

Var. *α*. TYPICA, Bth. l. c. (*C. angustissima*, Lamk. Dict. I. 650; *C. mimosoides*, var. *Telfairiana*, Hook. Bot. Mag. t. 5874; *Senna sensitiva* and *S. tenella*, Roxb. Fl. Ind. II. 353 and 354), leaves almost sessile, the rachis often marginate; leaflets only about a line long, very narrow; pods nearly glabrous. All parts more or less glabrous.

Var. *β*. ÆSCHYNOMENE, Bth. l. c. (*C. myriophylla*, Wall. Cat. 5326; *C. mimosoides*, *β*. *myriophylla* and *auricoma*, Bth. l. c.; *Senna dimidiata*, Roxb. Fl. Ind. II. 352), leaves on a short pubescent petiole; leaflets 2—3 lin. long, broader or narrower oblong to linear, the rachis marginate or not; pods more copiously appressed pubescent, while young usually pilose from yellow soft spreading hairs.

HAB. Var. *α*. common amongst long grass in the jungle-pastures and savannahs, also entering the open and dry forests, all over Burma; var. *β*. a shade-loving form in similar localities in Tenasserim.—Fl. Fr. R. and begin. of CS.

Bauhinia, L.

Conspectus of Genera.

* Trees or erect shrubs, without tendrils.

Subg. 1. *Pileostigma*, Hochst. Stamens 10, all fertile. Style very short or wanting, the stigma peltate. Flowers small.

Calyx valvate, the segments all free ; glabrous trees, ... *B. Malabarica.*

Calyx spathaceous ; young shoots and underside of leaves pubescent, ... *B. racemosa.*

Subg. 2. *Eu-Bauhinia.* Stamens 10, of which 5—9 sterile or reduced to staminodes, very rarely all 10 fertile.

× Calyx spathaceous.

\+ Pods sessile or acuminate and barely stalked.

Pods minutely tomentose, ... *B. brachycarpa.*

Pods glabrous, ... *B. polycarpa.*

\+ + Pods long-stalked.

Fertile stamen one only ; leaves shortly pubescent beneath, ... *B. monandra.*

Fertile stamens 5 ; young shoots puberulous ; leaves glabrous, ... *B. variegata.*

× × Calyx-lobes valvate, reflexed and free to the base, or only slightly cohering. Pods long-stalked.

\+ Pods glabrous. Petals white or purple.

A shrub, the leaves minutely puberulous beneath ; calyx in bud terete, ..*B. acuminata.*

A tree, the leaves glabrous ; calyx angular in bud, irregularly bursting, ..*B. purpurea.*

\+ + Pods brown-pubescent. Flowers yellow, turning orange-coloured.

Leaves velvety ; a small tree, ... *B. elongata.*

* * Scandent shrubs, with hook-tendrils.

Subg. 3. *Phanera.* Lour. Calyx-tube more or less elongate. Calyx-lobes valvate, all expanding or becoming reflected, rarely the one or other cohering. Style more or less elongate.

× Ovary and pod glabrous.

O Pod stalked. Flowers racemose, large.

Leaves 2-foliolate, the leaflets free to the base ; bracts or bractlets none, ... *B. diphylla.*

Leaflets united into a 2-cleft leaf ; bractlets very large, almost leafy, ... *B. involucellata.*

O O Pod sessile. Flowers rather small, corymbose.

Lobes of the leaves rounded ; pedicels and calyx glabrous, ... *B. glauca.*

Lobes of the leaves acuminate ; pedicels and calyx appressed silk-hairy, ..*B. piperifolia.*

× × Ovary, and usually also the pod, villous, pubescent or puberulous.

O Pod and ovary sessile.

† Adult leaves glabrous, the lobes acuminate to acute and bluntish.

Racemes elongate, appressed silk-hairy ; pedicels stout, ... *B. macrostachya.*

Racemes corymb-like contracted, sparingly puberulous ; pedicels slender, ... *B. ornata.*

† † Leaves tomentose or pubescent, the lobes rounded.

All parts brown-tomentose or pubescent ; petals an inch long ; racemes elongate, ..*B. Vahlii.*

O O Pod and ovary stalked.

Flowers rose-coloured, in corymb-like racemes ; style shorter than the ovary, villous, thick, ... *B. rosea.*

Flowers yellowish white to yellow, in short racemes ; style elongate, slender, ..*B. ferruginea.*

Subg. 4. *Lasiobema*, Korth. Calyx-tube almost none, the lobes tooth-like. Style very short. Pods 1—2-seeded.

Glabrous or nearly so ; ovary and pods glabrous,........................*B. anguina.*

1. B. MALABARICA, Roxb, Fl. Ind. II. 321 ; WA. Prod. I. 294. (*Pileostigma Malabaricum*, Bth. in Pl. Jungh. 261, in adn. ; Miq. Fl. Ind. Bat. I. 73).

HAB. Frequent in the upper mixed forests, rarely descending into the lower and the savannah forests, of Pegu ; and probably elsewhere.—Fl. Fr. CS.

2. B. RACEMOSA, Lamk. Encycl. Meth. I. 390, *non* Vhl. ; WA. Prod. I. 295 ; Bedd. Fl. Sylv. t. 182. (*B. parviflora*, Vhl. Symb. III. 55 ; Roxb. Fl. Ind. II. 323 ; *Pileostigma racemosum*, Bth. in Pl. Jungh. 262, in adn.; Miq. Fl. Ind. Bat. I. 73).

HAB. Common in the dry forests of the Prome district ; most probably also in Ava.—Fl. Fr. March, Apr.

3. B. BRACHYCARPA, Wall. Cat. 5786; Bth. in Pl. Jungh. 261 in adn.

HAB. Ava, Taong-dong (Wall.).

Unknown to me. The brief and incomplete description does not allow even of a guess as to its affinities.

4. B. POLYCARPA, Wall. Cat. 5785 ; Bth. in Pl. Jungh. 261 in adn.

HAB. Frequent in the upper mixed forests, from Pegu and Martaban down to Upper Tenasserim.—Fl. Apr. May; Fr. CS.

5. B. MONANDRA, Kurz in Journ. As. Soc. Beng. 1873, 73.

HAB. Burma, "Soeh doh" probably in Martaban or Upper Tenasserim (Brandis).

6. B. VARIEGATA, L. sp. pl. 535 ; Roxb. Fl. Ind. II. 319 ; WA. Prod. I. 296.—(*Phanera variegata*, Bth. in Pl. Jungh. I. 262 in adn. ; Miq. Fl. Ind. Bat. I. 60).

Var. α. PURPURASCENS, Voigt Cat. Hort. Calc. 253 (*B. variegata*, L. l. c. ; Roxb. l. c.), the 4 narrower petals purple, the fifth broader one tinged with cream and red.

Var. β. CANDIDA, Voigt l. c. (*B. candida*, Roxb. Fl. Ind. II. 318, *non* Ait.), the 4 narrower petals white or very pale purple, the fifth lower one somewhat sulphur-coloured in the centre, or purple towards the borders and yellow in the centre.

HAB. Var. β. chiefly, common in the dry forests and ascending into the upper dry forests of Ava and Prome ; Martaban, in the Yoonzeleen valley (Parish).—Fl. Febr. March ; Fr. CS.

7. B. PURPUREA, L. sp. pl. 536 ; Roxb. Fl. Ind. II. 320.—(*Phanera purpurea*, Bth. in Pl. Jungh. I. in adn. ; Miq. Fl. Ind. Bat. I. 60).

Var. *α.* GENUINA, flowers purple.

Var. *β.* TRIANDRA (*B. triandra*, Roxb. Fl. Ind. II. 320), flowers white, often with a yellowish blotch on the lower petal.

HAB. Var. *α.* sometimes planted in Burmese villages, as for example near Henzadah etc.; var. *β.* Ava, banks of the Irrawaddi (Wall. Cat. 5797 L.)—Fl. CS.

8. B. ACUMINATA, L. sp. pl. 536; Roxb. Fl. Ind. II. 324; WA. Prod. I. 295; Miq. Fl. Ind. Bat. I. 74. (*B. isopetala*, Griff. Not. Dicot. 451).

HAB. Frequent in the open forests, especially the eng-forests, all over Burma.—Fl. March—May; Fr. CS.

9. B. ELONGATA, Korth in Nat. Verh. Bot. 89. t. 24. (*Phanera elongata*, Bth. in Pl. Jungh. I. 262, in adn.; Miq. Fl. Ind. Bat. I. 61; *B. mollissima*, Wall. Cat. 5782; *Phanera velutina*, Bth. in Pl. Jungh. I. 262, in adn.; Miq. Fl. Ind. Bat. I. 63; *Bauhiniæ* sp., Griff. Not. Dicot. 451).

HAB. Pegu, in the tropical forests above Rangoon (Cleghorn); Tenasserim from Moulmein to Tavoy (Helf. 1872; Wall. etc.)—Fl. Decb. Jan.

10. B. DIPHYLLA, Symes Trav. to Ava t. 7.—(*Phanera diphylla*, Bth. in Pl. Jungh. 264, in adn.; Miq. Fl. Ind. Bat. I. 70).

HAB. Frequent in the dry forests of Ava and Prome.—Fl. RS.; Fr. ∞.

11. B. INVOLUCELLATA, Kurz in Journ. As. Soc. Beng. 1873, 72.

HAB. Martaban (Dr. Brandis).

12. B. GLAUCA, Wall. Cat. 5785 (*Phanera glauca*, Bth. in Pl. Jungh. 265; Miq. Fl. Ind. I. 68. t. 2).

HAB. Tenasserim, apparently frequent; also tropical forests above Rangoon (Cleghorn).—Fl. March, Jan.; Fr. Febr.

13. B. PIPERIFOLIA, Roxb. Fl. Ind. II. 327. (*Phanera glabrifolia*, Bth. in Pl. Jungh. 263, in adn.).

HAB. Tenasserim (Helf. 1879 and 1880).

NB. B. LUCIDA, Wall. (*Phanera lucida*, Bth. in Pl. Jungh. 262, in adn. = *B. cordifolia*, Roxb.).

14. B. MACROSTACHYA, Wall. Cat. 5774.—(*B. scandens*, Roxb. Fl. Ind. II. 326, *non* L.; Wight Icon. t. 264).

HAB. Ava, Khakyen hills, east of Bhamo (J. Anderson).

15. B. ORNATA, Kurz in Journ. As. Soc. Beng. 1873, 72.

HAB. Frequent in the tropical forests, along choungs of the eastern slopes of the Pegu Yomah.—Fl. Febr.

16. B. VAHLII, WA. Prod. I. 297. (*Phanera Vahlii*, Bth. in Pl. Jungh. 263, in adn.; Miq. Fl. Ind. Bat. I. 65; *Phanera rufa*, Bth. in Pl. Jungh. 263, in adn.?; *B. racemosa*, Vhl. Symb. III. 56. t. 62, *non* Lamk.; Roxb. Fl. Ind. II. 325).

HAB. Tenasserim, near Moulmein (J. Anderson, 1866).

17. B. ROSEA. Kurz in Journ. As. Soc. Beng. 1873, 72.

HAB. Martaban, in the eng-forests of Kaymapyoo choung (Dr. Brandis).—Fl. May.

18. B. FERRUGINEA, Roxb. Fl. Ind. 331; Korth in Nat. Verh. Bot. 93. t. 23 (*Phanera ferruginea*, Bth. in Pl. Jungh. 262, in adn.; Miq. Fl. Ind. Bat. I. 62; *Phanera excelsa*, Bl. ap. Miq. l. c.; *Phanera albolutea*, Miq. Suppl. Fl. Sum. 285; *Phanera Griffithiana*, Bth. in Pl. Jungh. 263, in adn.).

HAB. Tropical forests of the Martaban Hills, east of Tounghoo, at 2000 to 3000 feet elevation.

19. B. ANGUINA, Roxb. Corom. Pl. III. t. 285 and Fl. Ind. II. 728.—(*Lasiobema anguinum*, Korth. in Verh. Nat. Gesch. 84; Miq. Fl. Ind. Bat. I. 71; *Lasiobema Horsfieldii*, Miq. l. c.).

HAB. Not unfrequent in the tropical forests of Martaban, east of Tounghoo; also Chittagong.—Fl. RS.

Cynometra, L.

Conspectus of Species.

× Racemes short and umbel-like, puberulous.

Leaves and rachis glabrous; leaflets larger, usually in a single pair; 1½—2 in. long, edible, ... *C. ramiflora.*

Rachis of leaves puberulous, slenderer; leaflets smaller, usually in 2, very rarely in 3 pairs; pods about ½ in. long, insipid, ... *C. bijuga.*

× × Racemes longer or shorter, bracted.

Pedicels glabrous or puberulous; leaflets in a single pair, ... *C. cauliflora.*

1. C. RAMIFLORA, L. sp. pl. 547; Miq. Fl. Ind. Bat. I. 78; Bth. Fl. Austr. II. 296.

HAB. Rarely planted in villages of Tenasserim.

2. C. BIJUGA, Spanoghe in Miq. Fl. Ind. Bat. I. 78.

HAB. Frequent in the tidal and the beach-forests along the coasts, from Arracan down to Tenasserim and the Andamans.—Fl. Octob.; Fr. CS.

3. C. CAULIFLORA, L. sp. pl. 547; Miq. Fl. Ind. Bat. I. 77?

HAB. Burma, planted (according to the Revd. F. Mason).

Sindora, Liq.

1. S. SIAMENSIS, Teysm. in Miq. Ann. Mus. Lugd. Bat. III. 86. (*S. Wallichii*, Bth. in Hook. Icon. t. 1017—18).

HAB. Adjoining Siamese provinces.—Fl. Begin of RS.; Fr. HS.

Pahudia, Miq.

Conspectus of Species.

Leaflets in 5 pairs, thin coriaceous, rounded or apiculate, the rachis and petiolules stout; sepals about 3 lin. long, ... *P. Javanica.*

Leaflets in 2 pairs, blunt or emarginate, thin chartaceous, glaucescent beneath, the rachis and petiolules very slender; sepals 2 lin. long; pods woody, 3—4 in. long, very thick and plump, ... *P. xylocarpa.*

1. P. XYLOCARPA, Kurz MS.

HAB. Adjoining provinces of Siam (Teysmann).

P. Hasskarlii, Miq., has also only two pairs of leaflets, but Hasskarl's description of *Jonesia monopetala* (Retzia I. 199), and more especially of the pod, clearly points to *Macrolobium.*

Afzelia, Sm.

Conspectus of Species.

Inflorescence and calyx puberulous; pods ½—1 foot long, woody; leaflets usually bluntish, ... *A. bijuga.*

Inflorescence and calyx glabrous; pods 3—4 in. long, thin coriaceous; leaflets notched, .. *A. retusa.*

1. A. BIJUGA, A. Gray Unit. Stat. Expl. 467. t. 51; Walp. Ann. IV. 594.—(*Macrolobium bijugum*, Colebr. in. Linn. Trans. XII. t. 19; *Jonesia triandra*, Roxb. Fl. Ind. II. 220).

HAB. Not unfrequent in the coast-forests and beach-jungles of the Andamans.—Fl. May, June; Fr. Apr.

2. A. RETUSA, Kurz in Journ. As. Soc. Beng. 1873, 73.

HAB. Not unfrequent in the tidal forests along the coasts of the Andaman islands.—Fl. May.

Tamarindus, L.

*1. T. INDICA, L. sp. pl. 48; Roxb. Fl. Ind. III. 215; Heyne Arznei Gew. t. 221; Miq. Fl. Ind. Bat. I. 82; Bedd. Fl. Sylv. t. 184. (*T. officinalis*, Hook. Bot. Mag. t. 4563).

HAB. Generally cultivated in villages all over Burma, more especially in the drier parts, but apparently nowhere wild.—Fl. HS.; Fr. CS.

Amherstia, Wall.

1. A. NOBILIS, Wall. Pl. As. rar. I. t. 1 and 2; Miq. Fl. Ind. Bat. I. 87; Bot. Mag. t. 4453.

HAB. Planted around kyouks, chiefly in the southern parts of Burma; wild along streams in Martaban (Parish); Tenasserim.—Fl. Jan.—Apr.

Saraca, L.

1. S. INDICA, L. Mant. 98; Miq. Fl. Ind. Bat. I. 83; Bedd. Fl. Sylv. t. 57. (*Jonesia Asoca*, Roxb. Fl. Ind. II. 218; Bot. Mag. t. 3018; Wight Icon. t. 206; *Jonesia Zollingeriana*, Miq. l. c. 84).

HAB. Wild in the tropical forests of Arracan (Boronga Island, at 1000 feet elevation); also Tenasserim; much planted around monasteries all over the country.—Fl. Octob.

Poinciana, L.

Conspectus of Species.

Calyx greyish velvety ; petals crispate-fimbriate, yellow, ... *P. elata.*
Calyx quite glabrous ; petals very large, waved, usually crimson or orange-crimson, ..*P. regia.*

*1. P. REGIA, Boj. in Bot. Mag. t. 2884.

HAB. Frequently cultivated in the European stations all over Pegu.—Fl. H. and RS. ; Fr. R. and CS.

Parkinsonia, L.

*1. P. ACULEATA, L. Hort. Cliff. 157. t. 13 ; WA. Prod. I. 283 ; Griff. Not. Dicot. 447.

HAB. Frequently planted in Ava and Prome, and in the last-named district often like wild in woods and neglected lands.—Fl. nearly ∞.

Cæsalpinia, L.

Conspectus of Species.

Subg. I. Cæsalpinaria. Albumen none. Pods coriaceous, 2-valved. Filaments very long and slender, quite glabrous. Erect shrubs or trees, unarmed.

A glabrous shrub, the branchlets more or less pruinous, ... *C. pulcherrima.*

Subg. II. Eu-Cæsalpinia. Seeds albuminous. Pods various. Filaments as long as, or somewhat longer than, the petals. Usually scandent shrubs more or less armed with prickles.

A. Valves of pod dry, coriaceous or almost chartaceous.

Trib. 1. *Nugaria*, DC.—Scandent thorny shrubs, rarely trees. Pods rigidly or thinly coriaceous, 2-valved or indehiscent, smooth. Seeds compressed or not. Stamens as long as, or a little longer than, the petals.

* *Seeds flat and compressed. Pods 2-valved. Leaflets large.*

All parts quite glabrous, ... *C. nuga.*

* * *Seeds hardly compressed. Pods 2-valved or indehiscent or nearly so, the sutures usually thickened. Leaflets small.*

Small tree ; leaflets unequally oblong, retuse ; pods tardily dehiscing, ... *C. sappan.*
Scandent shrubs ; leaflets ovate, acute ; pods 2-valved, ... *C. sepiaria.*

Trib. 2. *Guilandina*, L.—Scandent thorny shrubs. Pods coriaceous or thin coriaceous, 2-valved, the valves echinate or glandular-hirsute. Seeds not compressed. Stamens as long as, or somewhat longer than, the petals.

* *Pods echinate. Seeds almost globose.*

Branchlets etc. more or less brown or tawny-pubescent ; stipules large, cut into large segments ; bracts at apex spreading or reflexed, ... *B. Bonducella.*
As preceding, but leaves more glabrescent ; stipules none ; bracts straight and erect, .. *C. Bondhuc.*

* * *Pods glandular-hirsute when fully ripe. Seeds oblong.*

All parts more or less glandular-puberulous and prickly, ... *C. mimosoides.*

B. Pods fleshy-coriaceous, torose.

Trib. 3. *Cinclidocarpus*, Zoll.—Thorny scandent shrubs. Pods indehiscent, the sutures thickened. Seeds not compressed. Stamens as long as, or somewhat longer than, the petals.

Panicle shortly tomentose and prickly, ... *C. tortuosa.*

Panicle glabrous and unarmed, ... *C. digyna.*

*1. C. PULCHERRIMA, Sw. Obs. 165; Miq. Fl. Ind. Bat. I. 112. (*Poinciana pulcherrima*, L. sp. pl. 554; DC. Prod. II. 484; Roxb. Fl. Ind. II. 355; Bot. Mag. t. 995).

HAB. Generally cultivated in villages, especially around monasteries etc., all over the country.—Fl. Fr. ∞.

2. C. NUGA, Ait. Hort. Kew III. 32; DC. Prod. II. 481; Miq. Fl. Ind. Bat. I. 108.—(*C. paniculata*, Roxb. Fl. Ind. II. 364; Wight Icon. t. 36; Griff. Not. Dicot. 446; *C. Chinensis*, Roxb. l. c. 361).

HAB. Rather frequent along the coasts, especially in the beach-forests, from Arracan down to Tenasserim and the Andamans.—Fl. May—Octob.

3. C. SAPPAN, L. sp. pl. 544; Roxb. Corom. Pl. I. t. 16; Miq. Fl. Ind. Bat. I. 101.

HAB. Frequent in the Tenasserim Provinces; Pegu, Rangoon (Wall). —Fl. Aug.

4. C. SEPIARIA, Roxb. Fl. Ind. II. 360; Miq. Fl. Ind. Bat. I. 109; Wight Icon. t. 37.—(*Reichardia ? decapetalum*, Roth. Nov. Spec. 210; DC. Prod. II. 484).

HAB. Burma (according to the Revd. F. Mason).

5. C. BONDHUC, Roxb. Fl. Ind. II. 362. (*Guilandina Bondhuc*, L. sp. pl. 545; Miq. Fl. Ind. Bat. I. 113).

HAB. Not unfrequent in the leaf-shedding forests of Burma, from Prome and Martaban down to Tenasserim and the Andamans.—Fl. RS.; Fr. ∞.

6. C. MIMOSOIDES, Lamk. Encycl. Meth. I. 457 and Ill. t. 335. f. 2; WA. Prod. I. 281; Wight Icon. t. 392.—(*C. Simora*, Ham. in Roxb. Fl. Ind. 359).

HAB. Frequent in the low forests of the Sittang zone of Pegu, especially about Tounghoo.—Fl. Fr. March, Apr.

7. C. TORTUOSA, Roxb. Fl. Ind. II. 365; Miq. Fl. Ind. Bat. I. 109. (*C. acanthobotrya*, Miq. Suppl. Fl. Fl. Sum. 108 and 293).

HAB. Tenasserim, Tavoy (Wall. Cat. 5827. C.).—Fl. Octob.

8. C. DIGYNA, Roth. in Nov. Act. Nat. Cur. Berol. 1803. 198. t. 3; WA. Prod. I. 281.—(*C. oleosperma*, Roxb. Fl. Ind. II. 357; *C. gracilis*, Miq. in. Fl. Ind. Bat. I. 110).

HAB. Frequent along choungs in the open forests, but more so in shrubberies around villages, all over Burma, from Ava and Martaban down to Tenasserim.—Fl. Jul.—Octob.; Fr. Jan.—Apr.

Pterolobium, R.Br.

1. P. MACROPTERUM, Kurz in Journ. As. Soc. Beng. 1873, 71.

HAB. Frequent in the mixed forests, from Pegu and Martaban down to Tenasserim.—Fr. Jan.

Mezoneurum, Desf.

Conspectus of Species.

Leaflets in 10 to 8 pairs, ½ in long, blunt or retuse, ... *M. glabrum.*
Leaflets in 3—4 pairs, 1½—2 in. long, bluntish acuminate, ... *M. cucullatum.*

1. M. GLABRUM, Desf. Mém. Mus. IV. 245. t. 10; Miq. Fl. Ind. Bat. I. 103.

Var. α. GENUINUM, glabrous or nearly so; leaflets usually alternate.

Var. β. ENNEAPHYLLUM (*M. enneaphyllum*, WA. Prod. I. 283, in adn.; Miq. Fl. Ind. Bat. I. 104. t. 2; *Cæsalpinia enneaphylla*, Roxb. Fl. Ind. II. 363), glabrous or the secondary rachises and young shoots slightly puberulous; leaflets glabrous or nearly so, usually opposite.

Var. γ. PUBESCENS (*M. pubescens*, Desf. in Mém. Mus. IV. 245. t. 2; Miq. Fl. Ind. Bat. I. 104), the young parts more or less velvety pubescent or puberulous; leaflets opposite or nearly so, at least beneath more or less shortly pubescent.

HAB. Var. β. frequent in the lower and upper mixed forests, more especially around villages and along shrubby banks of rivers, in the Irrawaddi zone of Pegu; var. γ. not unfrequent in the dry forests of the Prome district.—Fr. CS.

2. M. CUCULLATUM, WA. Prod. I. 283. (*Cæsalpinia cucullata*, Roxb. Fl. Ind. II. 358; *M. macrophyllum*, Bl. ap. Miq. Fl. Ind. Bat. I. 104).

HAB. Frequent in the mixed and the dry forests, all over Burma, from Ava and Chittagong to Pegu and Martaban.—Fl. Febr. March; Fr. Nov.

Peltophorum, Vog.

Conspectus of Species.

Pedicels only 2—3 lin. long; pods with coriaceous wings, ... *P. ferrugineum.*
Pedicels 1—1½ in. long; pods with thin chartaceous wings, ... *P. dasyrachis.*

1. P. FERRUGINEUM, Bth. in Fl. Austr. II. 279. (*Cæsalpinia ferruginea*, Dcne. in Nouv. Ann. d. Mus. II. 462; Miq. Fl. Ind. Bat. I. 111).

HAB. Not unfrequent in the coast-forests, chiefly the beach-forests, of the Andaman islands.—Fl. May.

Acrocarpus, Wight.

Conspectus of Species.

Flowers dirty purple or brown, small; petals 2 lin. long or somewhat longer; pods 8—12-seeded, ... *A. grandis.*

Flowers green, twice the size; petals 3 lin. long or longer; pods 17—18-seeded, ..*A. fraxinifolius*.

1. A. FRAXINIFOLIUS, Wight Icon. t. 254; Bedd. Fl. Sylv. t. 44.

HAB. Frequent in the tropical forests of the Pegu Yomah.—Fl. Jan. Febr.; Fr. Apr. May.

Adenanthera, L.

1. A. PAVONINA, L. sp. pl. 550; Roxb. Fl. Ind. II. 370; Wight Ill. t. 80; Miq. Fl. Ind. Bat. I. 46; Bth. in Linn. Trans. XXX. 375; Bedd. Fl. Sylv. t. 46.—(*Entada arborea*, Griff. Not. Dicot. 452; *A. Gersenii*, Scheffer in Nat. Tydsch. Ned. Ind. 1868. 16?).

Var. α. GENUINA, seeds about ⅓ in. in diameter.

Var. β. MICROSPERMA (*A. microsperma*, T. and B. in Nat. Tydsch. v. Ned. Ind. XXVII. 58; Bth. in Linn. Trans. XXX. 375), seeds half the size.

HAB. Var. β. frequent in the tropical and moister upper mixed forests, all over Burma and the adjacent islands, up to 3000 feet elevation. Fl. Apr. May; Fr. CS.

Entada, Adams.

1. E. SCANDENS, Bth. in Hook. Journ. Bot. IV. 332 and Linn. Trans. XXX. 363.—(*Mimosa scandens*, L. sp. pl. 1501; Roxb. Fl. Ind. II. 554; *E. Purshaeta*, DC. Prod. II. 425; Miq. Fl. Ind. Bat. I. 45; Scheff. in Nat. Tydsch. Ned. Ind. XXXII. 90. t. 16 and 18 A; *Entada* sp., Griff. Not. Dicot. 452; *E. Rumphii*, Scheff. in Nat. Tydschr. Ned. Ind. XXXII. t. 17. and 18. B.).

HAB. Frequent in all mixed forests, all over Burma and the adjacent islands.—Fl. March, Apr.; Fr. CS.

Neptunia, Lour.

1. N. OLERACEA, Lour. Fl. Cochinch. II. 840; Miq. Fl. Ind. Bat. I. 50; Bth. in Linn. Trans. XXX. 383.—(*Desmanthus natans*, Willd. sp. pl. IV. 1044; Griff. Not. Dicot. 453; *Mimosa natans*, Roxb. Corom. Pl. II. t. 119 and Fl. Ind. II. 553; *N. plena*, Ldl. Bot. Neg. t. 3, *non* Bth.).

HAB. Not unfrequent in stagnant waters and swamps of the alluvial plains of Pegu, Martaban, and Tenasserim.—Fl. RS.; Fr. CS.

Mimosa, L.

1. M. PUDICA, L. sp. pl. 1501; Bth. in Hook Journ. Bot. IV. 367; and in Linn. Trans. XXX. 397; Miq. Fl. Ind. Bat. I. 43.

HAB. An introduced weed, but now very common on dry grassy places, along road-sides, etc., of the more cultivated parts of Pegu, especially around Rangoon; also in Martaban, Ava, etc.—Fl. RS.; Fr. Sept.

Xylia, Bth.

1. X. dolabriformis, Bth. in Hook. Journ. Bot. IV. 417; and in Linn. Trans. XXX. 373; Bedd. Fl. Sylv. t. 186; Miq. Fl. Ind. Bat. I. 42. —(*Mimosa xylocarpa*, Roxb. Corom. Pl. I. t. 100 and Fl. Ind. II. 543).

Hab. Common in the mixed and dry forests, all over Burma and the adjacent provinces, up to 3000 feet elevation.—Fl. March, Apr.; Fr. CS.

Parkia, RBr.

Conspectus of Species.

* *Calyx-lobes obovate-cuneate.*

Leaflets an inch long, pubescent beneath, penninerved; receptacle regular, .. *P. insignis.*

* * *Calyx-lobes short, rotundate (not cuneate-narrowed.)*

Leaflets ½ in. long, quite glabrous, 1-nerved with a lateral basal nerve; receptacle irregular, ... *P. leiophylla.*

Leaflets ½—⅓ in. long, very narrow, sparingly pubescent beneath, 1-nerved without lateral nerves; receptacle regular, ... *P. Roxburghii.*

1. P. insignis, Kurz. in Journ. As. Soc. Beng. 1873, 74; Bth. in Linn. Trans. XXX. 361.

Hab. Not unfrequent in the tropical forests of Martaban, east of Tounghoo.—Fl. Apr. May.

2. P. leiophylla, Kurz in Journ. As. Soc. Beng. 1873, 73; Bth. in Linn. Trans. XXX. 361.

Hab. Frequent in the tropical forests of the Pegu Yomah, especially along its eastern slopes.—Fl. HS. ?; Fr. Febr. March.

Acacia, Willd.

Conspectus of Species.

* *Trees or erect shrubs, the branchlets armed only with paired diverging stipulary or infra-stipulary prickles.*

× Flowers in spikes.

\+ Pod-valves chartaceous, transversely reticulate-veined, the sutures nerve-like or almost keeled.

Glaucous-green, glabrous; leaflets oblong-linear, blunt, 3—5 lin. long; flowers yellow, ... *A. ferruginea.*

\+ + Pod-valves coriaceous, the margins not or hardly prominent.

Spikes glabrous or pubescent, yellow; leaves glabrous or slightly pubescent; bark much cracked and rough, dark brown, ... *A. Catechu.*

Spikes tomentose, white; leaves while young greyish pubescent; bark rather even and smooth, white, ... *A. Suma.*

× × Flowers in globular heads, yellow.

\+ Pods dry-coriaceous, flat, dehiscent.

Bark whitish; flower-heads arranged in ample terminal panicles, ... *A. leucophloea.*

\+ + Pod thick, torose, fleshy-coriaceous, indehiscent.

Glabrous or nearly so; leaves $1\frac{1}{2}$—3 in. long, leaflets 2—3 lin. long, ...*A. Farnesiana.*

* * *Woody climbers, without stipulary spines, but the branchlets armed along their whole length with sharp recurved prickles. Flower-heads globular.*

× Pods fleshy-coriaceous, often somewhat constricted between the seeds.

Leaflets in 10—20 pairs, up to $\frac{1}{2}$ in. long; flower-heads small, yellowish,....*A. rugata.*

× × Pods dry, chartaceous or thin coriaceous, flat.

O Ovary and pods pubescent.

Leaflets in 15—40 pairs, 3—6 lin. long; flower-heads small, white, in panicles, ..*A. caesia.*

O O Ovary and pods glabrous.

Leaflets in 8—20 pairs, $\frac{1}{2}$ in. long; peduncles tawny tomentose,............*A. Intsia.*

Leaflets in 30—40 pairs, 2—3 lin. long; flower-heads the size of a large pea; panicles and young branchlets puberulous or tomentose, not pruinous, ...*A. pennata*

As preceding, but branchlets and panicles pruinous; leaflets up to $\frac{1}{2}$ in. long; flower-heads twice the size,.......................................*A. pruinescens.*

1. A. FERRUGINEA, DC. II. 458; Bth. in Hook. Lond. Journ. Bot. I. 508. and in Linn. Trans. XXX. 518; WA. Prod. I.273; Bedd. Fl. Sylv. t. 51.—(*Mimosa ferruginea*, Roxb. Fl. Ind. II. 561).

HAB. Burma (according to Beddome).

2. A. CATECHU, Willd. sp. pl. IV. 1079; Miq. Fl. Ind. Bat. I. 9; Bth. in Linn. Trans. XXX. 519. (*Mimosa Catechu*, L. f. Suppl. 495; Roxb. Fl. Ind. II. 563 and Corom. Pl. II. 40. t. 174).

Var. *α.* GENUINA (*A. catechuoides*, Bth. in Hook. Lond. Journ. I. 510; *Mimosa catechuoides*, Roxb. Corom. Pl. II. t. 175 and Fl. Ind. II. 562), young parts all slightly appressed pubescent but soon glabrescent; full-grown leaves glabrous or the leaflets ciliate, the rachis slightly pubescent; spikes shorter and thicker, like the calyces more or less appressed pubescent; corolla about twice the length of the calyx.

Var. *β.* SUNDRA (*A. Sundra*, DC. Prod. II. 458; Bth. in Hook. Lond. Journ. I. 510; *Mimosa Sundra*, Roxb. Corom. Pl. III. t. 225 and Fl. Ind. II. 562; Bedd. Fl. Sylv. t. 50), all parts glabrous or the very young shoots slightly pubescent; full-grown leaves and rachis quite glabrous; spikes elongate and slender, quite glabrous; corolla glabrous, about $\frac{2}{3}$ longer than the glabrous calyx.

HAB. Var. *α.* common in the dry forests, rarely in the lower mixed and savannah forests of Ava and Prome, extending into the Irrawaddi zone of Pegu; var. *β.* apparently in Ava.—Fl. Begin of RS; Fr. CS.

3. A. SUMA, Buch. in Voigt Hort. Calc. 260; Brand. For. Fl. 187; Bth. in Linn. Trans. XXX. 519.—(*Mimosa Suma*, Roxb. Fl. Ind. II. 563; *A. Catechu*, Bth. in Hook. Lond.; Journ. Bot. I. 510, non Willd.; Bedd. Fl. Sylv. t. 49.

HAB. Ava?

4. A. LEUCOPHLOEA, Willd. sp. pl. IV. 1063; Bth. in Hook. Lond. Journ. Bot. I. 103 and in Linn. Proc. XXX. 513; Miq. Fl. Ind. Bat. I.

9; Brand. For. Fl. t. 27; Bedd. Fl. Sylv. t. 48 (*Mimosa leucophloea*, Roxb. Corom. Pl. II. 27. t. 150).

Var. *α.* GENUINA, flower-heads the size of a pea, the stout peduncles, and also the pods, shortly tomentose; leaves slightly, the rachis more or less, pubescent.

Var. *β.* MICROCEPHALA (*A. microcephala*, Grah. in Wall. Cat. 5263), flower-heads half the size, the slender peduncles and the inflorescence puberulous; pods when fully ripe quite glabrous; leaves and their rachis glabrous.

HAB. Var. *α.* Ava, along the Irrawaddi (Wall. Cat. 5262); var. *β.* not unfrequent in the dry forests of the Prome district, up to 1000 feet elevation.—Fr. March.

The two varieties here adopted are very likely different species.

*5. A. FARNESIANA, Willd. sp. pl. IV. 1083; Bth. in Hook. Lond. Journ. Bot. I. 494 and in Linn. Trans. XXX. 502; Bedd. Fl. Sylv. t. 52. (*Vachellia Farnesiana*, WA. Prod. I. 272; Wight Icon. t. 300).

HAB. Frequently planted in villages all over Burma, more especially in Ava and Prome, where it is often found half-spontaneous.—Fl. Jan.

6. A. RUGATA, Ham. Wall. Cat. 5251; Bth in Hook. Lond. Journ. Bot. I. 514; *Mimosa rugata*, Lamk. Dict. I. 20. (1786).

Var. *α.* GENUINA, ovary villous; softer parts more pubescent.

Var. *β.* CONCINNA (*A. concinna*, DC. Prod. II. 464; Bth in Hook. Lond. Journ. Bot. I. 514 and in Linn. Trans. XXX. 531; *Mimosa concinna*, Willd. sp. pl. (1805) IV. 1039; Roxb. Fl. Ind. II. 565), ovary glabrous or nearly so; all softer parts more glabrous.

HAB. Var. *β.* frequent in the tropical and moister upper mixed forests, all over Burma down to Tenasserim and the Andamans.—Fl. March, Apr.; Fr. CS.

7. A. CÆSIA, Willd. sp. pl. IV. 1090; WA. Prod. I. 278; Bth. in Hook. Lond. Journ. Bot. I. 515 and in Linn. Trans. XXX. 530 in part. (*Mimosa caesia*, L. sp. pl. 1507, *non* Roxb.; *Mimosa torta*, Roxb. Fl. Ind. II. 566).

Var. *α.* GENUINA, leaflets only about 3 lin. long, more rigid, bluntish with or without a mucro; branches terete.

Var. *β.* ELEGANS, leaflets about ½ in. long, bristly acute, less rigid; branches 5-angular, retorsely prickly along the corners.

HAB. Var. *β.* not unfrequent in the tropical forests of the eastern slopes of the Pegu Yomah and in Martaban.—Fr. CS.

8. A. INTSIA, Willd. sp. pl. IV. 1091; Bth. in Hook. Lond. Journ. Bot. I. 515; Miq. Fl. Ind. Bat. I. 11. (*Mimosa Intsia*, L. sp. pl. 1508; Roxb. Fl. Ind. II. 565; *A. oxyphylla*, Grah. in Wall. Cat. 5252; Bth. l. c. 514; *Mimosa caesia*, Roxb. Fl. Ind. II. 565?).

HAB. Chittagong Hills; Ava, Khakyen Hills, east of Bhamo.

9. A. PENNATA, Willd. sp. pl. 1090; Bth. in Hook. Lond. Journ. I. 516, excl. syn. Roxb. and in Linn. Trans. XXX. 531 in part only; Miq. Fl. Ind. Bat. I. 12.—(*Mimosa pennata*, L. sp. pl. 1507; Roxb. Fl. Ind. II. 565; *A. prensans*, Lowe in Bot. Mag. t. 3408).

Var. *α*. GENUINA, panicles puberulous; flower-heads the size of a large pea; young branchlets shortly puberulous; leaflets glabrous; rachis glabrous or slightly pubescent; pods linear-lanceolate, acuminate at both ends.

2. Var. *β*. CANESCENS (*A. canescens*, Grah. in (Wall. Cat. 5256), panicles and young branchlets tomentose; leaflets ciliate; rachis tomentose; pods linear-oblong, rounded at both ends, smooth, pale-coloured.

HAB. Var. *α*. common in all leaf-shedding forests, all over Burma and the adjacent provinces; var. *β*. Ava.—Fr. CS.

The two varieties here adopted offer differences which are rather of specific value.

10. A. PRUINESCENS, Kurz MS.

HAB. Not unfrequent in the tropical forests of the southern Pegu Yomah; also Ava, Khakyen Hills, east of Bhamo (J. Anderson).

This species has flower-heads twice the size of those of the preceding; and the branchlets, inflorescence, and peduncles are more or less pruinous, with or without an admixture of tomentum. It is a powerful climber, with somewhat compressed dark-coloured stems up to 3 feet girth. The tough reddish bark and fibre are used for poisoning fish.

Albizzia, Durazz.

Conspectus of Species.

Subg. 1. *Eu-Albizzia.* Pods straight very flat, the sutures slightly thickened. Flowers white.

* *Pinnae numerous* (10—18); *leaflets linear*, 1—6 *lin. long, in very numerous pairs.*

× Leaflets bluntish, the nerve central or nearly so.

Leaflets very narrow, glabrous; flower-heads small, in terminal panicles, ..*A. myriophylla.*

× × Leaflets more or less acute, the nerve marginal or nearly so. Trees.

Stipules very large, obliquely ovate, acuminate; all parts more or less shortly pubescent; corolla nearly 4 times as long as the calyx, ... *A. stipulata.*

Stipules none or obsolete; full-grown parts glabrous or nearly so, ... *A. elegans.*

* * *Pinnae in* 2—6 *pairs; leaflets ovate to oblong*, $\frac{1}{2}$—$1\frac{1}{2}$ *in. long, in several pairs.*

× Leaflets sessile.

Flowers small; calyx minute; corolla $1\frac{1}{2}$ lin. long; pods blackish or brownish black, ..*A. odoratissima.*

Flowers rather conspicuous; calyx $1\frac{1}{2}$ lin. long; corolla 4 lin. long; pods yellowish, ..*A. Lebbek.*

× × Leaflets shortly petioluled. Pinnæ in 4—3 pairs.

Leaflets blunt or somewhat acute, $\frac{1}{2}$—1 in. long, glaucescent beneath; pods tapering at the base, linear, smooth, brown, ... *A. procera.*

Leaflets very like those of *Cassia Fistula*, usually emarginate-bluntish, $2\frac{1}{2}$—4 in. long; pods stalked, oblong, veined, black, ... *A. Teysmanni.*

* * * *Pinnae in a single pair; leaflets few only, large, acuminate.*

Glabrous; pods broad, very flat,...*A. lucida.*

Subg. 2. *Pithecolobium*, Mart. Pods twisted circinately or screw-like or curved. Flowers white.

* *Flowers pedicelled, in head-like umbels or racemes. Trees.*

+ Branchlets terete.

Leaves with a single pair of pinnæ; leaflets in 2—3 pairs, smooth and glossy; seed-bearing lobes of pod about an inch long and broad, ...*A. Jiringa.*

+ + Branchlets sharply angular.

Leaves with about 12 pairs of pinnæ; leaflets in 4—8 pairs, while young shortly and softly pubescent like all younger parts, acuminate, ...*A. heterophylla.*

* * *Flowers sessile, in small heads.*

Erect shrub; leaves with a single pair of pinnæ; leaflets in 4—8 pairs, almost glabrous, glaucous beneath, ...*A. glomeriflora.*

1. A. MYRIOPHYLLA, Bth. in Hook. Lond. Journ. Bot. III. 90 and in Linn. Trans. XXX. 567.—(*Mimosa microphylla*, Roxb. Fl. Ind. II. 549, non Willd.).

HAB. Tenasserim (Falconer).—Fl. Apr.

2. A. STIPULATA, Boiv. Encycl. XIX. siècl. II. 33; Bth. in Hook. Lond. Journ. Bot. III. 92 and in Linn. Trans. XXX. 568; Miq. Fl. Ind. Bat. I. 28; Bedd. Fl. Sylv. t. 55.—(*Mimosa stipulata*, Roxb. Hort. Beng. 40; *Mimosa stipulacea*, Roxb. Fl. Ind. II. 549; *Mimosa Smithiana*, Roxb. l. c. 550).

HAB. Frequent in the tropical and moister upper mixed forests, ascending into the hill-forests up to 4000 feet elevation, from Chittagong and Ava down to Tenasserim and the Andamans.—Fl. Apr. May; Fr. CS.

3. A. ELEGANS, Kurz in Pegu Rep. App. B. 47.

HAB. Not unfrequent in the tropical forests of the eastern slopes of the Pegu Yomah, especially along the feeders of the Swa choung, etc.

Very similar to the preceding, but a much more elegant tree; flowers and fruits unknown. I have the very same plant from the island of Banka (Sumatra).

4. A. ODORATISSIMA, Bth. in Hook. Lond. Journ. Bot. III. 88 and in Linn. Trans. XXX. 565.; Bedd. Fl. Sylv. t. 54.—(*Mimosa odoratissima*, Roxb. Corom. Pl. II. 12. t. 120 and Fl. Ind. II. 546; *A. micrantha*, Boiv. Encycl. XIX. siècl. II. 33; Miq. Fl. Ind. Bat. I. 24).

HAB. Frequent in the mixed and dry forests, all over Prome, Pegu, and Martaban down to Tenasserim.—Fl. HS.; Fr. CS.

5. A. Lebbek, Bth. in Hook. Lond. Journ. Bot. III. 87 and in Linn. Trans. XXX. 562; Bedd. Fl. Sylv. t. 53?—(*Mimosa Lebbek*, L. sp. pl. 1503; *Mimosa Sirissa*, Roxb. Fl. Ind. II. 544; *A. latifolia*, Boiv. Encycl. XIX. sièel. II. 33; Miq. Fl. Ind. Bat. I. 22; *Mimosa speciosa*. Jacq. Icon. rar. I, 19. t. 198).

Hab. Frequent in the tropical and moister upper mixed forests, from Pegu and Martaban down to Tenasserim and the Andamans; a pubescent variety rare along choungs in the Prome district.—Fl. Apr. May; Fr. CS.

6. A. procera, Bth. in Hook. Lond. Journ. Bot. III. 89 and in Linn. Trans. XXX. 564; Miq. Fl. Ind. Bat. I. 21; Brand. For. Fl. t. 26. (*Mimosa procera*, Roxb. Corom. Pl. II. 12. t. 121 and Fl. Ind. II. 548; *Mimosa elata*, Roxb. Fl. Ind. II. 546).

Hab. Frequent in the mixed and the dry forests, entering also the tidal savannahs, all over Prome, Pegu, and Martaban down to Tenasserim. —Fl. May, June; Fr. CS.

7. A. Teysmanni, Kurz MS.

Hab. Adjoining Siamese province of Radbooree.—Fr. HS. (ton-sak of the Siamese).

8. A. lucida, Bth. in Hook. Lond. Journ. Bot. III. 86 and in Linn. Trans. XXX. 560; Miq. Fl. Ind. Bat. I. 18.—(*Mimosa lucida*, Roxb. Fl. Ind. II. 544).

Hab. Common in the dry forests of Ava and Prome; rather rare in the lower mixed forests of Pegu.—Fl. Apr.; Fr. CS.

9. A. Jiringa (*Mimosa Jiringa*, Jack. in Mal. Misc. I. 14; *Mimosa Djiringa* and *Kœringa*, Roxb. Hort. Beng. 40; and Fl. Ind. II. 543; *Pithecolobium lobatum*, Bth. in. Hook. Lond. Journ. Bot. III. 208 and in Linn. Trans. XXX. 575; Miq. Fl. Ind. Bat. I. 33).

Hab. Rather frequent in the tropical forests, and along choungs in the moister upper mixed forests, of the Pegu Yomah; and from Martaban down to Tenasserim; also much planted in villages.—Fl. Apr. May; Fr. March. Apr.

10. A. heterophylla (*Mimosa heterophylla*, Roxb. Fl. Ind. II. 545; *Pithecolobium angulatum*, Bth. in Hook. Lond. Journ. Bot. III. 208 and in Linn. Trans. XXX. 580; Miq. Fl. Ind. Bat. I. 34; *Pithecolobium acutangulum*, Miq. Suppl. Fl. Sumatr. 282).

Hab. Frequent in the drier hill-forests, also in the pine-forests, from the Martaban Hills down to Tenasserim, at 4000 to 6000 feet elevation. —Fl. March, Apr.; Fr. Apr. May.

11. A. glomeriflora, Kurz in Journ. As. Soc. Beng. 1873, 74; Bth. in Linn. Trans. XXX. 560.

Hab. Not unfrequent in the drier hill-forests of the Martaban Hills, east of Tonnghoo, at 4000 to 7000 feet elevation.—Fl. March.

Inga, Willd.

*1. I. DULCIS, Willd. sp. pl. IV. 1005; Wight. Icon. t. 198. (*Mimosa dulcis*, Roxb. Corom. Pl. I. 67. t. 99 and Fl. Ind. II. 556; *Pithecolobium dulce*, Bth. in Hook. Lond. Journ. Bot. III. 199 and in Linn. Trans. XXX. 572; Miq. Fl. Ind. Bat. I. 40, Bedd. Fl. Sylv. t. 188; *Albizzia dulcis*, F. Muell.).

HAB. Only planted in the larger stations where Europeans reside.—Fl. CS.; Fr. HS.

ROSACEÆ.

Conspectus of Genera.

A. Carpels solitary or united into a solid 2- or more-celled ovary. Fruit indehiscent.

* *Ovary superior. Fruit a drupe. Calyx or its lobes usually deciduous.*

Trib. 1. *Chrysobalaneæ.* Flowers usually irregular. Style basilar. Ovules 2, ascending. Radicle inferior.

PARINARIUM.—Petals 5 or 4. Stamens perigynous; filaments filiform; anthers small. Ovary and drupe 2-celled.

Trib. 2. *Pruneæ.* Flowers regular. Style almost terminal. Ovules 2, suspended. Radicle superior.

PRUNUS.—Calyx 5-lobed. Petals 5, usually conspicuous. Drupe with a bony putamen, straight.

PYGEUM.—Calyx 5—15-toothed. Petals 5—10, minute or none. Drupe often transversely didymous, coriaceous.

* * *Ovary inferior. Fruit an apple or a 1—5-pyrenous drupe.*

Trib. 3. *Pomeæ.**—Ovary-cells 1—5, with 2 ovules in each cell. Leaves simple to lobed and pinnate. Flowers regular.

PIRUS.—Calyx-limb deciduous or persistent. Ovary and apple 2—5-celled, the endocarp often cartilaginous. Leaf-shedding trees or shrubs.

ERIOBOTRYA.—Calyx-limb persistent. Ovary and berry 1—5-celled, the endocarp and septa thin. Evergreen trees.

B. Carpels usually numerous, rarely few, connate or more usually distinct and inserted on a torus or enclosed in the calyx-tube. Fruit-carpels indehiscent, or rarely dehiscent (in *Spireae*, etc.)

* *Carpels distinct, within the persistent calyx-tube, which forms a compound spuriously inferior fruit.*

Trib. 4. *Rosaceæ.*—Calyx without bractlets. Petals usually 5. Carpels many, 1-ovuled. Achenes dry, enclosed in the fleshy calyx-tube.

ROSA.—Shrubs, often prickly, with unpaired pinnate leaves and showy flowers.

* * *Carpels distinct, on a conspicuous torus, when ripe forming a superior compound dry or sappy fruit.*

Trib. 5. *Rubeæ.*—Stamens and carpels numerous. Ovules 2, suspended. Calyx without bractlets.—Shrubs or undershrubs, often prickly, with compound, rarely simple, leaves.

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* Decaisne's treatise on this group has not yet reached me.

Rubus.—Characters of the Tribe.

Trib. 6. *Potentilleæ.*—Stamens and carpels 4 or more, the latter with a solitary ovule; style usually ventral, marcescent or caducous. Calyx usually with bractlets. Unarmed herbs or undershrubs, with compound or simple leaves.

Fragaria.—Calyx with 5 bractlets. Stamens numerous. Ripe carpels crustaceous, seated on a fleshy sappy torus; styles ventral. Herbs with 3-foliolate leaves.

Potentilla.—Calyx with 4 or 5 bractlets; torus in fruit dry, rest as in preceding. Herbs or undershrubs with variously compound leaves.

Parinarium, Juss.

1. P. Sumatranum, Bth. in Fl. Nigrit. 334; Miq. Fl. Ind. Bat. I. 1. 353.—(*Pterocarya Sumatrana*, W. Jack in Maccl. Calc. Journ. IV. 165).

Hab. Burma, without locality, probably Upper Tenasserim (Brandis); frequent in the adjoining provinces of Siam, where the fruit is called 'makloke.'

Prunus, L.

Conspectus of Species.

* *Leaf-shedding trees or shrubs. Flowers appearing before or along with the young foliage. Vernation of leaves conduplicate or convolute.*

Subg. 1. *Amygdalus*, L.—(*Armeniaca*, Juss.) Flowers solitary or clustered. Drupes densely velvety or tomentose.

Leaves narrow, 2-glandular at the base; stone wrinkled, ... *P. Persica.*

Subg. 2. *Prunus.*—Flowers solitary, fascicled or racemose. Drupes glabrous.

* *Drupes usually pruinous. Vernation of leaves convolute.*

Glabrous; flowers rather small, usually by threes; petals $\frac{1}{3}$ in. long; calyx-tube 1—1$\frac{1}{2}$ lin. long, lobes usually somewhat longer, ... *P. triflora.*

Almost glabrous; flowers rather large, by 2 or 3 from bracted buds; petals nearly $\frac{1}{2}$ in. long; calyx-tube 3$\frac{1}{2}$ lin. long, the lobes nearly as long, ... *P. Puddum.*

* * *Drupes smooth, not pruinous. Vernation of leaves conduplicate.* (*Cerasus*, Juss).

* * *Evergreen trees. Flowers racemose.* (*Pygeopsis*).

Drupes an in. long; lateral nerves very faint or almost obsolete, ... *P. Martabanica.*

Drupes $\frac{1}{2}$ in. long; lateral nerves thin but prominent, anastomosing along the margins, .. *P. Javanica.*

*1. P. Persica, Brand. For. Fl. 191. (*Persica vulgaris*, Mill. Dict. No. 1; DC. Prod. II. 531; Spach Suit. t. 5; Boiss. Fl. Orient. II. 640; *Amygdalus Persica*, L. sp. pl. 677; Heyne Arzney Gew. IV. t. 38; Bot. Reg. t. 1586; Journ. Hort. Soc. Lond. III. t. 313; Houtte Fl. d. serr. X. t. 969. XIII. t. 1299. 1300 and 1319; Roxb. Fl. Ind. II. 500).

Hab. Much cultivated in Ava, as for example in the Khakyen Hills and about Bhamo.—Fl. Febr. March; Fr. June, July.

2. P. triflora, Roxb. Hort. Beng. 38 and Fl. Ind. II. 501, "trifolia" errore typogr.—(*Cerasus triflora*. Lindl. in Wall. Cat. 720).

HAB. Ava, Khakhyen Hills (J. Anderson).—Fl. Octob., Nov.

NB. There is a leaf-specimen of another *Prunus* from the Khakhyen hills in HBC. which differs from *P. pseudo-cerasus*, Ldl., only very slightly in the smaller size and in the serrature of its leaves.

3. P. PUDDUM, Roxb. ap. Voigt Cat. Hort. Calc. 200 (*Cerasus Puddum*, Wall. Pl. As. rar. II. t. 146; DC. Prod. II. 537; *P. sylvatica*, Roxb. Fl. Ind. II. 501).

HAB. Ava, Khakyen Hills.

4. P. MARTABANICA, Kurz in And. Rep. ed. 2. 37. (*Cerasus Martabanica*, Wall. Cat. 4902).

HAB. Rather frequent in the tropical forests of the Andamans; Tenasserim.—Fr. May.

Pygeum, Gærtn.

Conspectus of Species.

* *Ovary tawny villous.*

Leaves beneath more or less tawny villous, ... *P. arboreum.*

* * *Ovary glabrous or sparingly hirsute.*

Glabrous; nerves and veins conspicuous and deeply immersed so as to render the surface of the leaves almost wrinkled, ... *P. acuminatum.*

Young branchlets, petioles, and nerves beneath pubescent; nerves and veins thin, little visible, ... *P. persimile.*

1. P. ARBOREUM, Endl. Gen. plant. 1250 in part. (*P. parviflorum*, T. and B. in Nat. Tydsch. Neerl. Ind. II. 309; Miq. Fl. Ind. Bat. I/1, 361; *Polydontia arborea*, Bl. Bydr. 1105 in part).

HAB. Tenasserim (Helfer 2053); Taipo mountains, at 4000 feet elevation (Dr. Brandis).

2. P. ACUMINATUM, Colebr. in Trans. Linn. Soc. XII. 360. t. 18, *non* Wight Icon.; Miq. Fl. Ind. Bat, 1/1. 162).

HAB. Chittagong (Hf. and T. Th.).

3. P. PERSIMILE, Kurz in Journ. As. Soc. Beng. 1872, 306.

HAB. Tenasserim (Helfer 2056).

Allied to *P. latifolium*; general appearance exactly that of *P. Lampongum*, Miq.

The genus *Pygeum* is so closely allied to the section *Pygeopsis* of *Prunus* with evergreen foliage as to make it difficult to keep it distinct. Indeed, *Pygeum* and *Pygeopsis*, combined, stand pretty much in the same relation to *Prunus* as *Eriobotrya* does to *Pirus*.

Pirus, L.

Conspectus of Species.

* *Flowers usually by pairs from the axils of the leaves, or spuriously racemose from the non-developement of young foliage. Ovary-cells many-ovuled.* (*Cydonia*, Tourn.)

Young parts, pedicels, and calyx densely white-woolly; petals an inch long; fruits pear-shaped, 1—1½ in. long, crowned by the calyx-limb, ... *P. Indica.*

* * *Flowers corymbose or panicled at the end of the branchlets or in the axils of the upper leaves. Ovary-cells 2-ovuled.*

Flowers corymbose, on slender pedicels 1—2 in. long; fruits globose, the size of a bullet, ... *P. Pashia.*

Flowers panicled, very shortly and stoutly pedicelled; fruits as in preceding, ..*P. granulosa.*

1. P. Indica, Roxb. Fl. Ind. II. 511; Wall. Pl. As. rar. II. t. 173. (*Cydonia Indica*, Spach Hist. nat. veg. II. 158; Wenzig in Linnæa 1874. 12).

Hab, Ava. Taong dong (Wall).; Ponsee, Khakhyen Hills (J. Anderson).—Fl. March; Fr. Sept.

2. P. Pashia, Don. Fl. Nep. 236; Wenzig in Linn. 1874. 48. (*P. variolosa*, Wall. Cat. 680; G. Don. Dichlam. Pl. II. 622).

Hab. Ava, Khakhyen Hills, east of Bhamo (J. Anderson).—Fl. March; Fr. Aug.

3. P. granulosa, Bertol. in. Mem. d'Accad. d. sc. d. istit. d. Bologna Ser. 2. IV. 10. t. 3. sub nom. *P. granulata*.—(*P. Karensium*, Kurz in Journ. As. Soc. Beng. 1872. 306).

Hab. Not unfrequent in the drier hill-forests, especially the stunted ones, of the Martaban Hills, east of Toungboo, at about 7000 feet elevation. Fr. March. Apr.

Eriobotrya, Ldl.

(*Photinia*, Ldl.)

Conspectus of Species.

× Leaves entire.

Calyx and panicle puberulous; berries the size of a pea, ... *E. integrifolia.*

Quite glabrous; fruit an apple of the size of a bullet, ... *E. macrocarpa.*

× × Leaves coarsely crenate, at least towards the apex; inflorescence rusty or tawny woolly-tomentose.

Leaves glabrous; calyx about a line long, ... *E. dubia.*

Leaves woolly-tomentose beneath; calyx 3—4 lin. long, ... *E. Japonica.*

1. E. integrifolia (*Photinia integrifolia*, Ldl. in Trans. Linn. Soc XIII. 103; Bot. Reg. t. 1956; DC. Prod. II. 631; Wenzig in Linn. 1874. 88; *Photinia Notoniana*, WA. Prod. I. 302; Wight Icon. t. 991 and Spicil Neilgh. t. 64, Illustr. Ind. pl. t. 86; Bedd. Fl. Sylv. t. 192.; *Photinia eugenifolia*, Lindl. Bot. Reg. t. 1956).

Hab. Frequent in the stunted forests of the Nattoung mountains in Martaban, east of Toungboo, at an elevation above 7000 feet.—Fr. March, Apr.

2. E. macrocarpa, Kurz in Journ. As. Soc. Beng. 1872. 306.

Hab. Rare in the tropical forests on the Kambala toung of the Pegu Yomah, at about 2000 feet elevation.—Fr. March, Apr.

The fruits look more like apples, but the tree is evergreen. The very same tree occurs also in the outer hills of the Sikkim Himalaya.

3. E. dubia (*Photinia dubia*, Lindl. in Trans. Linn. Soc. XIII. 104. t. 10; DC. Prod. II. 631; Wenzig in Linn. 1874. 94; *Mespilus Bengalensis*, Roxb. Fl. Ind. II. 510; *Photinia Bengalensis*, Wall. ap. Voigt Hort. Calc. 198 excl. syn. Ldl.).

Hab. Frequent in the damp hill-forests of the Martaban Hills, east of Tounghoo, at 6000 to 7000 feet elevation; Ava Hills, east of Bhamo (J. Anderson); Chittagong (Roxb.).—Fl. March.

*4. E. Japonica, Lindl. in Trans. Linn. Soc. XIII. 103; WA. Prod. I. 302; Wight Icon. t. 226; Sieb. and Zucc. Fl. Jap. I. 182. t. 97; Wenzig in Linn. 1874. 97.—(*Mespilus Japonica* Thbg. Fl. Jap. 205; Vent. Jard. Malm. I. t. 19; Bot. Reg. t. 365; Roxb. Fl. Ind. II. 510).

Hab. The 'loquat' is but rarely cultivated in the larger towns of Pegu, such as Rangoon.

Rosa, L.

Conspectus of Species.

Sect. 1. *Systylæ.* Styles connate into a column. Flowers in corymbs.

Flowers small, pink; calyx glabrous or pubescent, the lobes short and entire; leaflets small, pubescent beneath; stipules pinnatifid, ... *R. multiflora.*

Flowers large, white; calyx glandular-tomentose, one or more of the lobes usually lobed; leaflets glabrous; stipules entire, ... *R. moschata.*

Sect. 2. *Eleuterostylæ.*—Styles all free.

* *Calyx-throat pervious and not closed by the disk.*

Flowers large, usually corymbose; calyx glabrous or sparingly glandular; leaflets glabrous, glaucous beneath; carpels about 40 to 50, ... *R. Indica.*

As preceding, but leaves solitary; carpels about 15, ... *R. damascena.*

Leaflets small; flowers solitary; calyx-tube and the globular fruits densely echinate, .. *R. microphylla.*

* * *Calyx-throat completely closed by the disk.*

Calyx, younger branchlets, and the globular fruits densely tomentose; flowers white, .. *R. involucrata.*

Leaflets wrinkled, opaque; calyx and peduncles hispid, ... *R. rubiginosa.*

1. R. involucrata, Roxb. ap. Lindl. Monogr. Ros. 8; Roxb. Fl. Ind. II. 513; DC. Prod. II. 602; Bot. Reg. t. 739; Wight Icon. t. 234.

Hab. Ava, Irrawaddi plains from Mandalay northwards, in savannahs.—Fl. Jan. Febr.

NB. Several species of roses (especially *R. Indica* and *R. damascena*) are found planted, around khyoungs chiefly, in almost every one of the larger villages of Pegu.

Rubus, L.

Conspectus of Species.

* *Carpels few, only 3—6. Leaves simple.*

Petioles very short; flowers in large terminal panicles, ... *R. pyrifolius.*

* * *Carpels numerous, forming a sort of sappy berry.*

× Leaves entire or lobed.

\+ All softer parts and the underside of the lobed leaves covered with a dense tomentum usually intermixed with longer hairs. Calyx-lobes entire.

Bracts and stipules entire or subulate-toothed, sometimes very deeply so and in this case the lobes short, ... *R. rugosus.*

Bracts and stipules pinnately cut, the segments long, thin, and often filiform, . . *R. Moluccanus.*

\+ + All parts, except the inflorescence, without tomentum, rather glabrous or pubescent.

Calyx-lobes pectinate-toothed, ... *R. ferox.*

× × Leaves digitately 3—5-foliolate.

Branchlets almost terete; leaflets green, shortly puberulous; stipules and bracts linear, entire, shortly glandular-pubescent; flowers white, ... *R. pentagonus.*

Branchlets terete; leaflets glabrous or pubescent; stipules and bracts usually cut into 1—2 linear segments, glabrous or only very sparingly and shortly glandular-hairy; flowers red, ... *R. alpestris.*

× × × Leaves pinnately 3-foliolate or unpaired-pinnate.

O Fruits tomentose.

Leaves unpaired pinnate, the leaflets beneath white or yellowish tomentose; flowers white, ... *R. lasiocarpus.*

O O Fruits glabrous.

Leaves pinnately 3-foliolate, the leaflets white or yellowish tomentose beneath; petals white, ... *R. flavus.*

Leaves unpaired-pinnate, uniformly green; petals white, ... *R. rosaefolius.*

1. R. PYRIFOLIUS, Sm. Icon. Ined. fasc. III. 61; DC. Prod. II. 567; Miq. Fl. Ind. Bat I/1. 384. (*R. hexagynus*, Roxb. Fl. Ind. II. 516; WA. Prod. I. 299; *R. Indicus*, Lesch. in DC. Prod. II. 568).

HAB. Hills of Ava.—Fl. March.

2. R. MOLUCCANUS, L. sp. pl. 707; DC. Prod. II. 566; Miq. Fl. Ind. I/1. 382; Bth. Fl. Austr. II. 439.—(*R. Moluccus latifolius*, Rumph. Herb. Amb. V. 78. t. 47. f. 2.)

VAR. *α.* GENUINUS, leaves beneath clothed with a short tomentum intermixed with a few longer hairs only, the basal lobes usually diverging; calyx velvety and at the same time densely tawny and appressedly hirsute, the lobes acuminate.

Var. *β.* ALCEÆFOLIUS (*R. alceæfolius*, Poir. Encycl. Suppl. VI. 247; DC. Prod. II. 567; Miq. Fl. Ind. Bat. I/1 379), leaves softly pubescent beneath, the basal lobes usually much converging; calyx densely tawny or yellowish appressed hirsute, the lobes acuminate.

? Var. γ. ABNORMALIS, stems covered with spreading tawny hairs; leaves of var. α.; calyx shortly and densely greyish or whitish tomentose without any admixture of longer hairs, the lobes acute or almost blunt.

HAB. Var. α., often passing into β., frequent on the Martaban Hills, as well in the drier hill-forests as in hill-toungyas and deserted cultivated lands, from 2500 to 7000 feet elevation; var. γ. Burma probably Ava (Griff. 2147).—Fl. Febr. March.

3. R. FEROX, Wall. Cat. 724; Focke in Abhandl. Nat. Ver. Bremen IV. 196. (*R. Moluccanus*, Roxb. Fl. Ind. II. 518 et ejusd. Icon. MS. IX. t. 32. f. 1853).

HAB. Burma, probably Ava (Griff. 2145).

4. R. PENTAGONUS, Wall. Cat. 731; Focke in Abh. Nat. Ver. Brem. IV. 192).

HAB. Not uncommon in the damp hill-forests along hill-streams, on the Nattoung mountain, east of Toungkoo, at 6000—7000 feet elevation.—Fl. March.

I formerly combined *R. alpestris* and this species, but Mr. O. Kuntze of Leipzic, who revised the species of *Rubus* in HBC., has pointed out to me the differences between the two.

5. R. LASIOCARPUS, Sm. in Rees. Cycl. XXX.; DC. Prod. II. 558; WA. Prod. I. 699; Wight Icon. t. 232. (*R. albescens* and *R. racemosus*, Roxb. Fl. Ind. II. 519; *R. Mysorensis*, Heyne in Roth Nov. sp. 235; DC. l. c. 557; *R. Horsfieldii*, Miq. Fl. Ind. Bat. I/1. 375. t. 7).

HAB. Ava, hills east of Bhamo (J. Anderson); Karenee country (O'Riley).

6. R. FLAVUS, Ham. ap. Don. Prod. Nep. 234; DC. Prod. II. 559. —(*R. Gowreephul*, Roxb. Fl. Ind. II. 517; WA. Prod. I. 298; Wight Icon. t. 231).

HAB. Hills of Ava, Taong dong (Wall.); Kakhyen Hills (J. Anderson); Martaban Hills, east of Tounghoo (Rev. F. Mason).—Fl. Febr. March.

7. R. ROSÆFOLIUS, Sm. Icon. in ed. III. 60. t. 60; DC. Prod. II. 556; Miq. Fl. Ind. Bat. I/1. 375; Bot. Mag. t. 1783 c. fl. plen.; Hook. Icon. Pl. t. 349; Lodd. Bot. Cab. t. 158; Bth. Fl. Austr. II. 431. (*R. rosaeflorus*, Roxb. Fl. Ind. II. 519).

Var. α. ASPER (*R. asper*, Don. Prod. Nep. 234), stem, branches, and petioles more prickly and covered with long stiff blackish gland-hairs; calyx and peduncle tomentose-pubescent, with long spreading gland-bristles; leaves more or less appressed hairy; flowers usually in poor corymbs.

Var. β. GLABRIUSCULUS, stems, branches, and petioles glabrous or with few short gland-hairs only; peduncles and pedicels usually shortly glandular-pubescent, rarely almost glabrous; calyx glabrous or sprinkled

with few short gland-hairs, velvety-tomentose inside; leaves more glabrous; flowers much larger, usually solitary on leaf-opposed long pedicels.

Hab. Var. *α*. Rather frequent in the hill-forests of Martaban, at 3000—4000 feet elevation, freely springing up in hill-toungyas; var. *β*. Ava Hills, especially those east of Bhamo.—Fl. Apr.

The above two forms are probably better treated as separate species, The branches are more or less terete or angular.

Fragaria, L.

1. F. Indica, Andr. Bot. Rep. t. 475; Bot. Reg. t. 61; DC. Prod. II. 571; WA. Prod. I. 300; Wight Icon. t. 989. (*Fragaria Malayana*, Roxb. Fl. Ind. II. 520; *Duchesnea fragarioides*, Sm. in Trans. Linn. Soc. X. 373; Miq. Fl. Ind. Bat. I. 372).

Hab. Ava, Bhamo and Tapeng valley (J. Anderson); Chittagong, Comilla (C. B. Clarke).—Fl. Fr. Febr. March.

Potentilla, L.

1. P. Kleiniana, WA. Prod. I. 300; Wight Ill. t. 85. (*Duchesnea Sundaica*, Miq. Fl. Ind. Bat. I/2. 372. t. 6).

Hab. Ava, Khakyen Hills, Ponsee (J. Anderson).—Fl. Fr. March.

SAXIFRAGEÆ.

Conspectus of Genera.

Trib. 1. *Saxifrageæ.*—Herbs, often scapigerous. Leaves alternate. Stipules none. Flowers 5-merous. Ovary 1—3-celled.

Astilbe.—Petals 5 or none. Stamens 8 or 10. Carpels nearly free. Herbs with ternatisect leaves. Flowers panicled.

Trib. 2. *Hydrangeæ.*—Trees or shrubs. Leaves opposite. Stipules none. Petals often valvate. Stamens usually epigynous. Ovary usually 3—5-celled.

Dichroa.—Petals 5 or 6, valvate. Styles 3—5, club-shaped. Fruit a berry.

Trib. 3. *Escallonieæ.*—Trees or shrubs. Leaves alternate. Stipules none. Stamens usually as many as petals.

Itea.—Ovary half-superior, 2-celled. Style separable into two. Capsule superior, 2-beaked.

Polyosma.—Ovary inferior, 1-celled. Style simple. Fruit a 1-seeded berry.

Polyosma, Bl.

1. P. Wallichii, Benn. Pl. Jav. rar. 196; Hf. and Th. in Linn. Proc. II. 77.

Hab. Tropical forests of the Andamans, not rare.—Fl. RS.

Very near to *P. ilicifolia*, Bl., but the flowers are smaller and the fruits different.

CRASSULACEÆ.

Conspectus of Genera.

BRYOPHYLLUM.—Calyx large, inflated, shortly 4-cleft.
KALANCHOE.—Calyx 4-parted.

Bryophyllum, Salisb.

1. B. PINNATUM (*Kalanchoe pinnata*, Pers. Ench. I. 446; Miq. Fl. Ind. Bat. I/1. 728; *B. calycinum*, Salisb. Parad. Lond. t. 3; DC. Prod. III. 396; WA. Prod. I. 360; Wight. Ill. Ind. Bot. Suppl. 55. t. 31; Bot. Mag. t. 1409; *Cotyledon pinnata*, Lam. Encycl. Meth. II. 141 (1786); *Cotyledon rhizophylla*, Roxb. Fl. Ind. II. 456; *Colydedon calycina*, Roth Nov. sp. 217).

HAB. Frequent in rubbishy or waste places, ruins, etc., chiefly around villages, all over Burma and the adjacent provinces. Fl. Jan. Febr.

Kalanchoe, Adans.

Conspectus of Species.

× Panicles glandular-puberulous.
Leaves pinnatifid, the lobes flattened, lobed or cut, ... *K. laciniata.*
× × Panicles quite glabrous.
Leaves simple or pinnately 3-foliolate, crenate, ... *K. acutiflora.*
Leaves pedately 3-pinnatisect, the segments almost terete, sulcate, ... *K. teretifolia.*

1. K. LACINIATA, DC. Pl. grass. t. 100 and Prod. III. 395; WA. Prod. I. 360; Wight Icon. t. 1158.—(*Cotyledon laciniata*, L. sp. pl. 615; Roxb. Fl. Ind. II. 456).

HAB. Ava, Irrawaddi valley (J. Anderson).

2. K. ACUTIFLORA, Haw. Syn. 109; Bot. Rep. t. 560; Miq. Fl. Ind. Bat. I. 728. (*K. varians*, Wall. Pl. As. Soc. rar. II. 53. t. 167 sub. nom. *K. subamplectens, non* Haw.; Hf. and Thoms. in Linn. Proceed. II. 91, quoad specim. Birmanica).

HAB. Not unfrequent in uncultivated places along the Irrawaddi in Ava.—Fl. Jan.

3. K. TERETIFOLIA, Haw. in Wall. Pl. As. rar. II. 53. t. 166; Hf. and Th. in Linn. Proc. II. 91.

HAB. Pegu, near Rangoon? (*teste* Wallich); Ava, Taong dong (Wall.).—Fl. Jan.

DROSERACEÆ.

Conspectus of Genera.

DROSERA.—Stamens 4—8. Styles 2—5, simple, 2-parted, or many-cleft. Ovary 1-celled. Glandular-pilose herbs, scapiferous or not.
ALDROVANDA.—Stamens 5. Styles 5, filiform. Ovary 1-celled. Glabrous, floating herbs with whorled leaves.

Drosera, L.

Conspectus of Species.

× Leaves radical or nearly so, rosulate. Scapes leafless.
Leaves obovate-spathulate; flowers white or pale rose, ... *D. Burmanni.*

× × Leaves scattered. Scapes leafy.

Leaves linear ; flowers purple, ... *D. Indica.*

Leaves peltate, half-orbicular or crescent-shaped ; flowers white, ...*D. peltata.*

1. D. BURMANNI, Vhl. Symb. III. 50 ; Wight Ill. t. 20, excl. stigma ; Wight Icon. t. 944 ; Planch. in Ann. d. sc. nat. ser. 3. IX. 190 ; Hf. and Th. in Linn. Proc. II. 82.

HAB. Chittagong (Hf. and Th.) ; very rare in grass-lands in the eng-forests of the Prome district.—Fl. March.

2. D. INDICA, L. Fl. Zeyl. 51 ; Wight Ill. t. 20 ; Planch. in Ann. d. sc. nat. 3 ser. IX. 204 ; Hf. and Th. in Linn. Proc. II. 82.

HAB. Not unfrequent in wet short-grassed pastures and swamps of of the diluvial lands of Southern Pegu, chiefly about Rangoon, etc. ; Tenasserim, Tavoy (Wall).—Fl. Aug.—Decemb.

3. D. PELTATA, Sm. Exot. Bot. I. 79. t. 41 ; Planch. in Ann. d. sc. nat. 3 ser. IX. 296 ; DC. Prod. I. 319 ; Bth. Fl. Austr. II. 465 ; WA. Prod. I. 34 ; Wight Illust. t. 20.—(*D. lunata*, Ham. in DC. Prod. I. 319 ; Hook. Icon. t. 54 ; Planch. in Ann. d. sc. nat. 3 ser. IX. 296 ; Hf. and Th. in Linn. Proc. II. 82 ; *D. Lobbiana*, Turcz. in Bull. d. Nat. Mosc. 1854. 343).

HAB. Not unfrequent on laterite grounds in the hill-eng-forests, from Martaban down to Upper Tenasserim, at 1500 to 3000 feet elevation ; also in boggy places on the top of the Nattoung, east of Tounghoo, at about 7100 feet elevation.—Fr. March Ap.

HAMAMELIDEÆ.

Conspectus of Genera.

BUCKLANDIA.—Flowers in heads, polygamous. Petals of male flowers linear. Filaments elongate. Evergreen trees, the stipules large, deciduous.

ALTINGIA.—Flowers in 1-bracted heads, unisexual. Stamens in male flowers head-like clustered. Petals none. Leaf-shedding trees. Stipules small.

Bucklandia, R.Br.

1. B. POPULNEA, R.Br. in Wall. Cat. 7414 ; Griff. in Asiat. Research. XIX. 94. t. 13 and 14 ; Miq. Fl. Ind. Bat. I/1. 836.—(*Liquidambar tricuspis,* Miq. l. c. 1097 and Suppl. Fl. Sum. 346. t. 4.)

HAB. Frequent in the damp hill and the stunted forests of the Martaban Hills, east of Tounghoo, at 4000 to 7200 feet elevation.—Fl. March.

Altingia, Noronh.

1. A. EXCELSA, Noronh. Verh. Bat. Genootsch. V. 1-20. (*Liquidambar Altingia*, Bl. Fl. Jav. Balsamifl. 8. t. 1—2 ; Miq. Ind. Bat. I/1. 836 ; *Sedgwickia cerasifolia*, Griff. in Asiat. Research. XIX. 98. t. 15—16).

HAB. Ava, Khakyen Hills, east of Bhamo (J. Anderson) ; Tenasserim, locally (as along the Nanta-yoke choung) quite abundant (Rev. F. Mason).—Fr. March.

(To be continued.)

XVII.—*On the* Helicidæ *collected during the Expedition into the Dafla Hills, Assam.—By Major* H. H. Godwin-Austen, *F. R. G. S., F. Z. S., &c., Deputy Superintendent Topographical Survey of India.*

This list contains nearly all the species of *Helicidæ* that were obtained during the Expedition of 1874—75.

There are still a few that have not yet been determined: they will be worked out and those of them that prove to be new described by Mr. G. Nevill, from the series presented by me to the Indian Museum.

I was in hopes that Mr. Nevill would have been able to join me in completing the list; but his many other duties and late unavoidable absence from Calcutta have prevented this, and as the plate must appear now, I am compelled to give it thus incomplete.

Helix lubrica, Bs.? Plate VIII, Fig. 9.

Until I had examined the animal I should have supposed it to possess the usual truncate glandular form at the extremity of the foot. It shews how carefully we should examine the living animals before grouping these very similar forms of *Helicidæ*, and how much has to be done in this direction. I give a description and drawing of this species.

Animal—fore part of foot and head, as well as the tentacles, dark slate, extremity of foot pointed (no gland visible), pale grey, edged light fleshy, sole of foot dark orange, mantle very slightly reflected in front, with no tongue-shaped process,—it is, in fact, very similar to that of *Vitrina.*

Length, 2·0″, tentacles 0·5″. Shell-major diam. 0·95″.

Hab.—Shengorh Peak, 7000 ft.

Helix (Nanina) bilineata, n. sp., Plate VIII, Fig. 8.

Shell globose, very thin, transparent, greenish yellow. Whorls 5, spire conoid. The living shell appears mottled on the upper surface with black and white from the body of the animal shining through its thin and transparent walls.

Animal—the foot pale ochraceous; tentacles black, the black extending on to the neck as two very conspicuous well-defined parallel lines; the upper part of the foot has also two parallel black lines. From the right anterior margin a long tongue-like process is given off, which reaches, when fully extended, up to the apex of the shell, as in the large form, *Nanina decussata.*

Hab.—Tanir Lampa ridge, 4000 ft. Very abundant in the forest among the fallen leaves.

Helix (Nanina) globosa, n. sp.

Shell very globose, thin and glassy, pale ochre, whorls 4, the last large and expanded below. Aperture broadly lunate. Apex rounded.

Alt. 0·28″, major diam. 0·40″.

Animal, dark grey, becoming pale fleshy on extremity of foot, which is broad behind, with the lobe over the gland much hooked. Tentacles rather thick at base. Length 1·2″, tentacles 0·2″.

Hab.—Summit of Toruputu Peak.

This shell is of the form of *H. salius,* but is much larger; and the animal differs considerably.

Helix (Rotula) vidua, W. Blf.

Both at Shengorh 7000 ft. and at the base of the hills at the Burroi gorge, and in the woods skirting the Pichola nulla, far out into the plains, a small globose form was found everywhere very abundant.

Alt. 0·28″, major diam. 0·50″.

Helix (Rotula) climacterica, Bs. Torúpútú Peak.

Helix remicola, Bs. Burroi Gorge.

Helix (Trochomorpha) acris, Bs. At low elevations.

Helix (Plectopylis) macromphalus, Bs. On Shengorh the form is very small, very dark coloured, and with a tendency to be hirsute. It does not differ in other respects, and was found generally distributed.

Helix (Nanina) oxytes, Bs. Of the usual typical form. General up to 7000 ft.

Helix (Trachea) cestus, Bs. Pichola nulla, in plains of Durrang.

Helix (Macrochlamys) honesta, Gould. Toruputu Peak.

Helix (Trochomorpha) diplodon, Bs. Outer hills, at low elevations.

Helix (Trochomorpha) castra, Bs. Burroi Gorge and banks of upper Dikrang River.

Helix (Plectopylis) plectostoma, Bs. Pichola nulla and Burroi Gorge,—common.

Helix Huttoni, var. *tapeina,* Bs. Burroi Gorge.

Helix (Nanina) bascauda, Bs. About 3000 ft. in Dikrang valley,—not common.

Helicarion ovatus, H. Blf.

This species, originally described from Darjiling, I was glad to find in this new locality so as to be able to add a description of the animal. It was tolerably abundant.

Animal dark slate colour on head, extremity of foot pale, with a rosy tint in middle of body. Length 1·1″, tentacles (rather short) 0·20″.

Hab.—Found on Shengorh peak, at 6000 feet.

HELICARION (HOPLITES) VERRUCOSUS, n. sp., Plate VIII, Fig. 5.

The shell with animal was placed in spirit, but has been unfortunately lost: it was thin and glassy, with about 4 whorls. I, however, made a careful drawing of the animal at the time it was taken, and described it thus:—

Animal dull purplish grey; mantle lobes, which can cover the entire shell, are very minutely mottled, and have a finely papillate surface. On the posterior margin are six blunt and larger wart-like processes, arranged 3 on the right and 3 on the left side. Posterior part of the foot well ribbed diagonally, in parallel lines; there is a distinct marginal line to the edge of the foot. The mucous gland is larger and the upper lobe well pointed. Tentacles moderate. The mantle is divided into three lobes, one of rectangular outline is on the anterior left margin. The shell when the animal is in motion is very slightly exposed.

Total length 1·25″, mantle 0·60″, mantle to extremity of foot 0·50″, tentacles 0·20″.

HAB.—Under Torúpútú Peak, at 4,600 feet. Found on decaying wood during damp weather.

Among some very excellent drawings of the late Dr. Ferd. Stoliczka is one of a *Helicarion* very similar to this in form and in the papillate surface of the mantle, only that the papillæ are more generally distributed, and the animal is of a dull brown colour.

HELICARION MINUTUS, n. sp., Plate VIII, Fig. 1.

Shell ovate, depressed, rather solid, brown with an olive tinge, and with a glazed polished surface. Whorls 3, very rapidly enlarging. Aperture oblique, elongately lunular.

Major diam. 0·22″, minor diam. 0·18″.

Animal pale horny, tentacles and a line from them to the mantle dark coloured, with a dark line down the upper surface of the extremity of the foot, which last is mottled on the side. The mantle just covers the edge of the shell and the right posterior lobe is moderately developed. The portion of the body anterior to the shell is very short in comparison to the posterior part.

It may be known from *H. salius* by its much flatter form.

The animal of *H. salius* from a living specimen taken at Mairang in the Khasi Hills is as follows:—

Pale yellowish, with a tinge of orange on foot; tentacles pale, short, a dusky line on upper surface of the posterior portion of foot. Mantle slightly reflected over the edge of the shell. Jumps about actively when handled. Shell (pale green) 0·30″. Length of animal 0·6″.

I have a form exactly similar from the west Khasi Hills, but none of the shells are so rich in their coloration.

HELICARION (HOPLITES) RADHA, n. sp., Plate VIII, Fig. 4.

Shell similar to that of *H. Shillongensis.* Animal rich ochre, sparsely dappled with grey-black on the mantle and tail.

Length 3·0″, head to mantle 0·50″, mantle 1·3″, mantle to end of foot 1·0″, tentacles 0·38″.

HAB.—Banks of Rádha Pokri (tank) near Narainpur, Darrang District,—only one specimen was found. This is a close ally of *H. brunnea* and *H. Shillongensis* of the Khasi Hills, but differs in coloration and in the markings of the mantle.

HELICARION (HOPLITES) CINEREUS, n. sp., Plate VIII, Fig. 2.

The shell was not described when taken and it has since been mislaid. The description of the animal, which is of more importance, I can give.

Animal, when fully extended, long and narrow, colour dusky grey, mantle with a papillated surface slightly spotted, the spotting being coarser on the body and tail. Tentacles short and blunt, with the oral ones very close below them.

Length 0·75″, mantle 0·40″.

HAB.—On the Darpang river, foot of the Dafla Hills, under old logs in the forest.

HELICARION (HOPLITES) BURTII, n. sp., Plate VIII, Fig. 6.

Shell dull white, very horny in texture, the apex scarcely developed, outline rounded above.

Major diam. 0·30″.

Animal grey-brown in colour, the largest measuring as follows:—

Mantle to head 0·40″; mantle 0·80″, mantle to extremity of foot 0·50″, or total length when moving about 1·5″.

HAB.—The Borelli Tea Garden near Tezpur, Assam, discovered by Mr. J. Burt, after whom I name it, and who found it abundant on the bark of trees during the rains (July). It is of the true typical form of *Hoplites*, but in its very rudimentary white, horny shell it is quite distinct from any of the other species I am acquainted with.

These molluscs are abundant during the rainy season in this part of India, but are hard to discover in the cold weather, and only then under stones and logs in damp low situations. In July I found *H. croceus* very plentiful just above Teria Ghat, and I observed them, when I was hunting for butterflies, crawling about over the tall grasses 12 feet from the ground.

TESTACELLA ? DIKRANGENSIS, n. sp., Plate VIII, Fig. 7.

Shell dextral, ovate, very flat, solid, the lines of growth well marked, with a dark brown epidermis, the apex cap-shaped, rather produced, and much curved.

Major diameter 0·50″, minor diam. 0·25″.

Animal not seen.

Two dead shells were found in a damp low piece of forest near the Dikrang river close under the village of Pachitah, or Camp 7.

The shell is a peculiar form, the body whorl spreading out and overlapping in front, giving the shell a limpet-like shape. Without a knowledge of the animal it is very difficult to say in what genus it should be placed, but it is probably a *Helicarion* form. The shell, however, so much resembles *Testacella* that I have placed it temporarily in that group.

Philomycus (Incillaria) campestris, n. sp., Plate VIII, Fig. 3.

No shell.

Animal pale ochre, with a longitudinal dark stripe on the side of body. Tentacles very short, only 0·13″. Total length 1·65″.

Hab.—Found on the damp grass early in morning at Kholabari in the Darrang District,—only one specimen seen.

I must here allude to a similar form of slug which I have recorded in my note-book as *Philomycus monticolus*, and which I sketched at the time it was taken in the hills bordering the Kopili river, North Cachar Hills. Animal white, tinged with pale lilac, having intensely black spots scattered over body, with one longitudinal band of same colour along the side, and one central down middle of back; foot white below; tentacles very short, brown, the two lower ones wide apart and very short indeed. Extremity of foot pointed. Total length one inch.

Opeas Nevilli, n. sp., Plate VIII, Fig. 12.

Shell turreted, very elongate, pale, silky with a green tinge, older specimens of a pale straw-colour, covered with a thin epidermis, beautifully striate under lens. Whorls 11—12, moderately rounded and very gradually diminishing in size to the apex, which is blunt; suture impressed; aperture angular above, outer lip thin.

Alt. 0·55″, major diam. 0·10″. Largest specimens, 0·90″.

Hab. This very delicate elongate shell was common on Toruputu Peak, but far finer specimens, equal in size to the figure, were obtained on the banks of the Pichola Nulla out in the plains. I am not satisfied with this figure; the whorls being rather too flat and the apex too sharp.

I have named this shell after my friend Mr. G. Nevill, with whom I have now so long been associated in the study and collection of Indian land-shells.

Achatina (Glessula) hebes.

Glessula crassilabris, Bs. Shengorh and Torúpútú.

Glessula illustris, G.-Austen. Torúpútú Peak. Found at the same altitude as the original typical form from the Nágá Hills. In forest.

Glessula orthoceras, G.-Austen. Splendid specimens of this shell were obtained at Harmutti and in the Burroi Gorge, where it was very common. The largest measure as much as 2·85 in length by 0·5″ in major diameter.

Glessula Cassiaca, Bs. Torúpútú.

Glessula Daflaensis, n. sp., Plate VIII, Fig. 10.

Shell elongately turreted, thick, obliquely striate, covered with a thick olive-green epidermis with a few dark streaks. Spire turreted, slightly convex in outline, apex blunt; whorls 11, rather flat, specimens with apex preserved shewing erosion of the surface. Suture well marked. Aperture oblique, suboval, pale grey. Peristome acute, columellar margin slightly curved and but little thickened.

Alt. 1·9″, major diam. 0·41″, alt. ap. 0·42″.

Hab.—Shengorh Peak, rather abundant. This shell would appear to have a close connection with *G. erosa*, H. Blf., from Darjiling, but its much longer form, greater number of whorls, and the different colour of its epidermis (which is uniform througbout); at once distinguish it. As in *G. erosa* the position of former apertures is distinctly indicated on the whorls.

Bulimus Masoni, n. sp.

Shell sinistral, acuminately oblong, thick, side of spire rather flat, whorls 7, smooth and shiny, under lens finely and spirally striate, colour sea-green, intenser below the keel, paling towards the apex, the columella dark purple, a narrow fillet of same colour borders the suture closely below, commencing at the upper and outer angle of the aperture. Aperture oval, angular above, lip slightly reflected. The last whorl slightly keeled.

Alt. 1·2″, major diam. 0·5″.

Hab. Dihiri Parbat, 2000 feet. Only two specimens were found.

This handsome *Bulimus* is very similar in form to *B. Sylheticus*, Reeve, but this latter shell is smaller, exhibits no trace of spiral striation, has its surface more polished, while the columellar margin and outer lip is pure white; and in dozens I have collected no trace of a band is ever seen. In colour too *B. Sylheticus* differs from the new form in being lemon-yellow with a greenish tinge on the body whorl. Reeve, I notice, erroneously describes it in the Conchol. Icon. Bul. 564 as bright yellow, and makes a great blunder about its habitat, which is given as "Sylhet, Eastern Himalayah," Sylhet being a district south of the Khasi Hills in the plains of Lower Bengal. The true home of *B. Sylheticus* is the southern slopes of the Khasi and Garo Hills; the title is therefore unfortunately misleading.

I have named this species after Mr. J. Wood-Mason, to whom I am indebted for much valuable aid both in securing collectors and preparing equipments for the field.

Bulimus gracilis, Hutton.

Bulimus Nilagiricus, Pfr. var. The form is more elongate than those I have from the Khasi Hills. It is always very local in its distribution. Found under Torúpútú Peak at 3000 feet.

Alt. 0·66″.

One of the forms so curiously like those of Southern India that crop up in this province now and then, *Cyclophorus nivicola* being another so like is it to *C. Bairdii.*

Bulimus (Harpalus) Khasiacus, G.-Austen. Dikrang valley at 2500 ft.

Streptaxis Theobaldi, Bs. Low down in the Dikrang valley. Similar to the Khasi type. I figure the aperture of this shell (pl. viii, fig. 15) to shew the difference between it and the following.

Streptaxis Daflaensis, n. sp., Plate VIII, Fig. 14.

Shell obliquely perforate, flatly ovate, minutely striated, white; spire much depressed, suture well marked, apex flattened, in one specimen quite flat. Whorls 6½, regular to the 4th, the 5th rapidly descending, the last compressed below near the umbilicus so as to form a fold running up to a second and shorter fold on the outer margin. Aperture oblique, subquadrate, peristome slightly reflected. Parietal lamella one, strongly developed and connected with the parietal callus. The palatal teeth are disposed, 2 on the upper and 2 on the lowers margin, with a single intermediate one, which extends further within the aperture than those above and below it.

Major diam. 0·32″, minor diam. 0·21″, alt. 0·15″.

Hab.—Near Tanir Peak, Dafla Hills, 4000 ft.

It is a much larger, more lengthened, and flatter shell than *S. Theobaldi*, and has a greater number of whorls. In the form of the aperture it is similar to that shell, but the parietal lamella is more developed and the central palatal tooth is not so remote from the peristome but rises close on the margin. The umbilicus also is more open.

Ennea stenopylis, Shengorh Peak, not a common shell.

Ennea milium, n. sp., Plate VIII, Fig. 11.

Shell cylindrical, dull glassy, diaphanous. Spire with flattish sides, very slightly tapering below, suture shallow. Whorls 6, the last 3 smooth, the apical sub-vertically ribbed, but slightly so. Aperture oval, vertical, last whorl ascending slightly to it. Peristome thickened, a little reflected, a single tooth-like thickening on the outer margin, with another single one on the parietal side.

Alt. 0·10″, major diam. 0·04″.

Hab.—Shengorh Peak, 7000 ft. A single specimen only was found on tearing off the thick growth of moss covering rocks.

This very distinct but minute *Ennea* bears somewhat the character of *E. Blanfordiana*, but in its minute size and differently formed aperture it is separable. It is the smallest species of the genus from this part of India.

Clausilia iös, Benson, Plate VIII, Fig. 13.

Compared with Darjeeling specimens in the Imperial Museum, Calcutta. Extending the range considerably to the eastward.

Carychium Khasiacum, n. sp., Plate VIII, A, Fig. 8.

This form, which has not been noted before, occurs very abundantly in the Khasi Hills, particularly in the large wood near the village of Nongba on the Jaintia side. I obtained specimens of it on Shengorh Peak which are rather larger than those from the above quarter. It is quite distinct from *C. Indicum*, Bs. and may be thus known from it :—

Beautifully minutely and regularly costulate throughout under lens. Whorls 6, more rounded, apex more acute ; the aperture circular and larger, peristome continuous forming a callus on the antepenultimate whorl, and the columellar tooth stronger. Alt. 0·09″.

I also give a drawing of *C. Indicum* (pl. viii. A, figs. 7*a*, *b*), which I do not think has been before figured ; the shell fig. 7 is like *C. Boysianum*, but the three shells here depicted were all found at Mussoorie, and *C. Boysianum* was originally obtained on the banks of the river Jumna near Agra.

EXPLANATION OF PLATE VIII.

Fig. 1. *Helicarion minutus*, n. sp.
„ 2. ——— *(Hoplites) cinereus*, n. sp.
„ 3. *Philomycus (Incillaria) campestris*, n. sp.
„ 4. *Helicarion (Hoplites) radha*, n. sp.
„ 5. ——— ——— *verrucosus*, n. sp.
„ 6. ——— ——— *Burtii*, n. sp.
„ 7. *Testacella ? Dikrangensis*, n. sp.
„ 8. *Helix (Nanina) bilineata*, n. sp., nat. size.
„ 9. *Helix lubrica ?* Benson.
„ 10. *Glessula Daflaensis*, n. sp.
„ 11. *Ennea milium*, n. sp.
„ 12. *Opeas Nevilli*, n. sp.
„ 13. *Clausilia iös*, Benson.
„ 14. *Streptaxis Daflaensis*, n. sp.
„ 15. ——— *Theobaldi*, Bs. the aperture, enlarged.

XVIII.—*On the Physical Explanation of the Inequality of the two Semi-diurnal Oscillations of Barometric Pressure.*—*By* HENRY F. BLANFORD, *Meteorologist to the Government of India.*

(Received June 22;—Read August 2, 1876.)

There are, perhaps, few phenomena in the domain of terrestrial physics which have received more attention than the diurnal variation of barometric pressure; and on the causes and explanation of which, nevertheless, there is more diversity of opinion even at the present day. Dove, Sabine, Herschell, Espy, Lamont, Kreil, Broun, and many others have in turn engaged in the discussion of this vexed problem; and, at the present time, Mr. Alexander Buchan is publishing an elaborate and most valuable *resumé* of the existing data in the Transactions of the Royal Society of Edinburgh, as a preliminary to a renewed investigation.

The general features of the diurnal variation of pressure are familiar enough to every one who has ever observed the rise and fall of the barometer for a few days in India, and most other tropical countries. From about 3 or 4 in the morning the pressure increases gradually towards sunrise, then more rapidly,—and culminates generally between 9 and 10 A. M. A fall then sets in, which becomes rapid during the hottest hours of the day, and the pressure reaches its minimum generally between 4 and 5 P. M. The pressure then increases till about 10 P. M.; but in general does not attain the same height as at the corresponding morning hour. Lastly, a second fall brings it to a second minimum between 3 and 4 A. M., which, except on mountain peaks and at such stations as Simla and Darjiling, is never quite so low as the afternoon minimum.*

Thus, then, the pressure rises and falls twice in the 24 hours, attaining, in general, its absolute maximum about 9 or 9.30 A. M., and its absolute minimum between 4 and 5 P. M.

This may be taken as a general description of the phenomenon as exhibited in the tropics; but it presents many striking variations at different

* I must correct this statement. I find, on examining the ship's observations for the month of January recorded in the Bay of Bengal, between N. Latitude 20° and the E. C. Light Ship, *i. e.*, between 60 and 100 miles from the coast, that the form of the diurnal barometric curve afforded by them, in this respect, resembles that of hill stations; the early morning minimum being considerably lower than the afternoon. The relation of this peculiarity to the phenomenon of the diurnal sea-breeze, and the confirmation it affords of the transfer of air from the land to the sea during the daytime, in the strata above that in which the sea-breeze prevails, which is the main topic of this paper, are obvious. I have not as yet obtained the data for other months.—*Note added January 20th*, 1877.

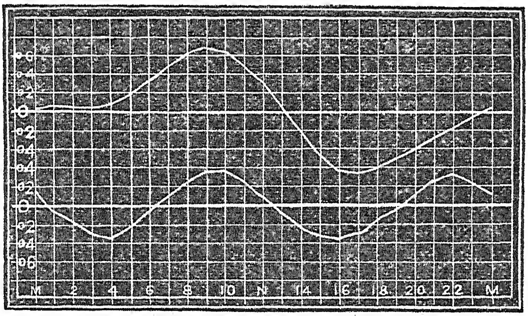
places, and at one and the same place at different times of the year. These variations affect the hour at which the pressure attains its maximum and minimum values, the absolute amplitude of the oscillations, and lastly, their relative amplitude. It is this phenomenon—the variation in the relative amplitude of the day and night oscillations—the probable physical explanation of which I have now to bring to notice.

It was observed by Arago, apparently some years prior to 1841, that in Europe "the proximity of the sea has the effect of diminishing the amplitude of the interval during which the diurnal fall lasts, viz., that which occurs between 9 A. M. and 3 P. M.;" and considering the whole phenomenon as made up of a single and double oscillation, it may easily be shewn that this interval is determined mainly by the relative amplitude of these two elements. The latest notice on the subject is given in the following extract from Mr. Buchan's Memoir, a copy of the first part of which, (for which I am indebted to the author,) has reached me only within the last week.* In summing up the characteristics of the midday fall of pressure, he says:—"Whatever be the cause or causes on which the diurnal oscillations of the barometer depend, the influence of the relative distribution of land and water in determining the absolute amount of the oscillation in particular localities as well as over extended regions, is very great. From the facts detailed, (in Mr. Buchan's paper), it will be seen that this influence gives a strong local colouring to the results, particularly along the coasts; and that the same influence is extensively felt over the Channel, the Mediterranean, the Atlantic, and other sheets of water on the one hand; and on the other over the inland portions of Great Britain, Europe, and the other continents;" and, further on, he adds:—"While, as has been pointed out, numerous illustrations can be adduced, shewing a larger oscillation over the same region with a high temperature and a dry atmosphere than with a low temperature and a moist atmosphere; the small summer oscillation on the coasts of the Mediterranean and those of the Atlantic adjoining, is in direct opposition to the idea that any such conclusion is general. For over those parts of the Mediterranean and Atlantic, the temperature is hottest in summer, and the air is driest—so dry, indeed, that no rain, or next to none, falls; and yet there, the amplitude of the oscillation now contracts to its annual minimum. On the western coasts of the Atlantic, from the Bahamas northwards to Newfoundland, the temperature is at the annual maximum, but the air is not dry, being liberally supplied with moisture, and the rainfall is generous. But with these very different meteorological conditions, there occurs, equally as in Southern Europe, a diminished oscillation during the summer months in the islands and near the coasts of North America; and, in the south of Europe, the

* Written in the beginning of March, 1876.

oscillation reaches its annual maximum, just at the season when the annual minimum occurs near the sea coasts, even although the general characteristics of the atmosphere be substantially the same in both cases."

I am not at present aware whether Mr. Buchan has been led by these observations to any definite conclusions as to the physical cause of the variation he so clearly summarizes in the passages above quoted. In the part of his memoir which has reached me, all theoretical discussion is deferred. But these passages afford such remarkable confirmation of an explanation at which I arrived some weeks since, on approaching the subject from an entirely different quarter, that I do not think it necessary to withhold longer the publication of my view. If Mr. Buchan's conclusions are the same as mine, the facts that I have to bring forward will serve to afford independent confirmation of that view.



Any person glancing over a series of curves illustrating the diurnal rise and fall of the barometer, cannot fail to be struck with the characteristic difference of those places with a continental and those with an insular climate. The case of the Mediterranean, described by Mr. Buchan, seems perhaps to be an exception; but, as I shall presently shew, it is an exception of such a kind as most strongly to confirm the rule. The accompanying curves are striking, perhaps extreme, examples of this characteristic difference. The first is that of Leh in Ladakh,* situated in the Indus valley (the observatory being 11,538 feet above the sea), and is for the month of September. The climate is characteristically dry, and the summer heat excessive, notwithstanding the elevation. The curve for Yarkand and Kashghar still further north and only 4,000 feet above the sea, is of similar character but smaller amplitude.† The second curve figured is that for the

* This is computed from the hourly observations recorded during six days by Captain E. Trotter, R. E., and of one day by Dr. J. Scully together with six days' observations by the latter at the hours of 4 and 10 A. M. and P. M.

† With respect to these curves however, see the final paragraph, page 328.

northern half of square 3 of the North Atlantic, published by the London Meteorological Office. In the former, the double oscillation has almost disappeared, the nocturnal fall of pressure being represented by little more than a halt for some hours between two periods of rising pressure; and nearly the whole fall of the day takes place between 9 A. M. and 5 P. M. In the case of the Atlantic curve, the day and night oscillations are almost exactly alike; the night oscillation being only slightly less than that of the day. These characteristic differences are perhaps best expressed by the ratio of the constant co-efficients U′ and U″ in Bessel's interpolation formula:—

$$x = \mathrm{M} + U' \sin (n\,\theta + u')\ U'' \sin (n\,2\,\theta + u'') + \&c.$$

since the magnitude of U' determines the inequality; and that of U'', though variable under different conditions of climate, is so to a much less extent than the former term, and chiefly depends on the latitude. The following are the values of U' and U'' in English inches, and their ratios, for the mean diurnal curves of a few stations (chiefly Asiatic). The arcs u' u'' corresponding thereto are also given.

C		U′	u′	U″	u′	U′ U″
Yarkand	(9 months)	·0348	4° 33′	·0215	161° 59′	1·6 : 1
Leh	(September)	·0517	343° 9′	·0254	143° 19′	2· : 1
Lucknow	(Year.)	·0265	341° 30′	·0355	168° 53′	0·75 : 1
Hazaribagh	„	·0193	349° 46′	·0343	145° 45′	0·56 : 1
Calcutta	„	·0265	341° 24′	·0391	151° 7′	0·68 : 1
Bombay	„	·0179	337° 17′	·0385	157° 13′	0·46 : 1
Batavia	„	·0240	24° 7′	·0369	159° 34′	0·65 : 1
Square 3.	Atlantic	·0055	354° 51′	·0319	159° 26′	0·17 : 1

As a general rule, the more humid the station and the smaller the range of temperature, the smaller is the value of U'; and hence it has sometimes been spoken of as the temperature element of the oscillation; the double oscillation which is superimposed on it, being referred by Dove, Sabine, and Herschel to the varying tension of water vapour, by Lamont and Broun to some solar influence other than heat, and by Espy and Kreil to the oscillation of pressure produced by heat in an elastic fluid expanding and contracting under the influence of gravity. To me it seems that there can hardly be a doubt that the last explanation is the true one,* and

* True, that is to say, as thus stated in general terms. I do not however fully accept the detailed explanation afforded by any of these authors; and I am disposed to think that a more probable explanation of the morning oscillation is to be found in the retardation which the transmission of the exalted pressure of the lower to the higher strata must meet with, in the great thickness of highly attenuated but exceedingly cold air which constitutes these strata. This pressure cannot be transmitted

that this has not been generally recognized, I attribute to the fact that the consequences of the theory, as a purely physical problem, have never yet been traced out and verified by such a mass of facts as Mr. Buchan is now bringing together. So long as the *whole* phenomenon is not satisfactorily accounted for, some doubt may reasonably attach to the explanation offered of one only of its elements.

My own attention was first drawn to the subject of the explanation which I am about to give, by a paper of Mr. F. Chambers in the Philosophical Transactions for 1873, in which that gentleman showed as the result of an analysis of the diurnal variation of the winds at Bombay, that one element of this variation is a double rotation of the wind direction; of such a character, that the southerly components attain their maximum value at the epoch of the most rapid semi-diurnal rise of pressure, the easterly components at the epoch of maximum, the northerly with the most rapid fall, and the westerly with the epoch of minimum. On these facts Mr. Chambers based a suggested explanation of the barometric tides, regarding them as a phenomenon of static pressure; and assumed (as now appears, on insufficient grounds) that the phenomenon in the northern hemisphere is generally of the same type as at Bombay. There was indeed one feature in his explanation, which it seems difficult to reconcile with mechanical laws; since he supposed air to flow from both east and west towards a region where the pressure has already risen above the mean, and by its accumulation to produce a maximum of static pressure. But apart from this, the discovery was an important one; and, since it clearly shewed that a regular horizontal transfer of air corresponded to the oscillations of pressure, it held out a promise that further steps in the same path might clear up what appeared to be anomalous, and possibly lead to a complete explanation of the diurnal oscillation.

Some time before this paper reached me, the Rev. M. Lafont had placed in my hands four years' traces of a Secchi anemograph, erected on St. Xavier's College, Calcutta; and these having been measured off, tabu-

with a greater velocity than the sound wave, and it is probably much less; since the action being slow and prolonged, the heat developed by the compression must be in part dissipated. To explain the observed phenomenon on this hypothesis, the retardation must however be such, that the unrelieved excess of pressure at the ground surface, must be equal to that generated by from half to three quarters of an hour's action of the sun.

This would require us to assume a much lower average temperature for the higher strata than results from Pouillet's calculation, and also that a certain diurnal oscillation of temperature affects the atmosphere to a greater height then has been usually assumed. But this hypothesis is free from most of the objections to be urged against those of the authors quoted.—*Note added January 20th*, 1877.

lated, and reduced, I was interested to find that the diurnal wind variation at Calcutta showed the double diurnal oscillation quite as distinctly, and relatively even more prominently than that of Bombay. But one important difference presented itself. The north and south elements of the oscillation, while agreeing in epoch with those of Bombay, were reversed in direction; and, taken together with the latter, showed a tendency to a cyclonic circulation of the atmosphere around the peninsula during falling pressure, and an anticyclonic circulation with rising pressure. Moreover, the east and west components agreed almost exactly, in epoch, with the north and south components; the result being a movement of air from the north-west with falling pressure, and from the south-east with rising pressure. These facts, taken in conjunction with the positions of Bombay and Calcutta on opposite sides of the peninsula, seemed to point to the differential conditions of land and water as being probably concerned in the phenomenon. Another and not less important fact connecting the winds with the diurnal oscillation of the barometer appeared at the same time. When the wind variation was analysed by Bessel's method, there appeared an east and west oscillation of considerable magnitude, corresponding in epoch with the barometric inequality expressed by the first periodical term of the barometric formula. This was easily distinguished from the oscillation of the sea and land winds, since the latter are nearly north and south at Calcutta. At Bombay where the sea and land breezes are nearly east and west, such an oscillation would be undistinguishable, even if it really existed.

The east and west oscillation of diurnal period indicates an outflow of air to the eastward during the day time, an inflow from the east during the night; and the former phase of it evidently corresponds to the hot winds of the Gangetic plain and Northern India and, indeed, to the day winds of the dry months of the greater part of India. They blow towards the sea from the eastward, only in the western portion of the Dekhan, Mysore, &c. This system of day winds consists of an outflow of air from the peninsular towards the sea on both coasts, the westerly direction greatly predominating.

The next step in the enquiry was to ascertain what general cause would operate to produce this efflux and influx of air; and the obvious suggestion was that it must consist in the differential action of the sun's heat on dry air and water.

Let V be any volume of dry air at pressure P and absolute temperature T and let τ units of heat be communicated to it, raising its temperature from T to $T+t$, while the volume remains constant. The pressure will be increased thereby from P to P$+p$ wherein—

$$p = P\left(\frac{T+t}{T} - 1\right) = P\,\frac{t}{T} \quad \ldots\ldots\ldots\ldots (1)$$

And $$\tau = V\rho \frac{P}{\mathrm{P}} \frac{\mathrm{To}}{T} tc \quad \text{......................... (2)}$$

Wherein ρ is the density of air at the standard pressure P and absolute temperature To and c its specific heat at constant volume, compared with water as unity.

If now the same quantity of heat τ be employed in evaporating water at temperature T, (the whole being consumed as latent heat) and filling the volume of air V with vapour at pressure p', the total pressure will become

$\mathrm{P} + p'$ and $$\tau = V\varsigma \frac{p'}{\mathrm{P}} \frac{\mathrm{To}}{T} \lambda$$

when ς is the hypothetical density of water vapour at P and To, and λ its latent heat at temperature T. Substituting for ς its approximate equivalent $\frac{5}{8}\rho$

$$\tau = V \tfrac{5}{8} \rho \ \frac{p'}{\mathrm{P}} \frac{\mathrm{To}}{T} \lambda \quad \text{.................. (3)}$$

and equating (2) and (3) and eliminating common factors,

$$p' = \frac{\mathrm{P}\ t\ c}{\frac{5}{8}\lambda} \quad \text{........................ (4)}$$

From (1) and (4).

$$p = p' \frac{5}{8} \frac{\lambda}{Tc} \quad \text{........................ (5)}$$

which gives the ratio of the increase of pressure produced by the same quantity of heat, employed in the one case simply in heating dry air, and in the other in charging it with vapour. At a temperature of 80° Fahr. $= T = 541$,

$$p = 7{\cdot}36\, p'$$

that is to say, when a given quantity of heat is employed in heating dry air at the temperature of 80° it raises its pressure more than seven times as much as when it simply charges it with vapour without altering the temperature. With lower values of T the difference will be still greater.*

This great difference is no doubt much reduced in nature by the effects of radiation; and while some evaporation is effected on the land surface, there is some increase of temperature over the sea: but it may be expected that some part of this difference will manifest itself in the greater intensity of the forenoon pressure in the lower strata of the atmosphere on the land as compared with the sea, and in fine clear weather as compared with cloudy weather, when banks of clouds present an evaporating surface. With

* Substituting for λ the general value determined by Regnault $1091{\cdot}7 - {\cdot}695\ (T - 493{\cdot}2)$ the general expression for the ratio becomes

$$p = \left(\frac{5400{\cdot}87}{T} - 2{\cdot}61\right) p'$$

regard to this latter point, it has been shewn by Lamont and Kreil's investigations, that between clear and cloudy days there is a difference of this kind; and that it is manifested, not only in the greater magnitude of the diurnal coefficient u', but also, although to a much less degree, in that of the semidiurnal coefficient u'' of the barometric formula. Further evidence of the same kind is afforded by the values of these coefficients for the several months at Calcutta.

	U'	u'	U''	u''
January, ...	·0287	330° 18′	·0415	151° 34′
February, ...	·0319	327° 12′	·0423	146° 48′
March, ...	·0343	329° 27′	·0437	146° 44′
April, ...	·0361	336° 53′	·0425	146° 38′
May, ...	·0325	344° 43′	·0385	148° 13′
June, ...	·0218	357° 28′	·0336	146° 23′
July, ...	·0192	2° 6′	·0396	150° 30′
August, ...	·0218	0° 5′	·0372	144° 29′
September, ...	·0232	354° 41′	·0400	151° 25′
October, ...	·0234	343° 12′	·0393	160° 59′
November, ...	·0250	337° 38′	·0399	164° 22′
December, ...	·0270	335° 18′	·0411	158° 55′

The driest months in Northern India being March and April, while July is the wettest and most cloudy.

On Espy and Kreil's hypothesis of the cause of the double oscillation, there is no apparent reason why the evening maximum, arising from contraction and dynamic pressure, should be equal to the morning maximum; which seems unquestionably due to the increased tension of the lower atmosphere, in consequence of heating and the introduction of vapour; and any inequality will of course appear in the value of u' or of the coefficients of other terms of odd periodicity. But the fact established by the anemometer, that an outflow of air from a heated land area takes place during the day time, at once assigns a cause for the greater part of the equality, *viz.* an alteration of the static pressure. This is not an overflow in the upper regions of the atmosphere, but an outflow of the lower strata* or a tendency in that direction. It does not, of course, follow that, to produce a reduction in the mass of air over a contiment, there should be an actual motion of the air outwards in all directions. The very small forces in action will be manifested even more in retarding inflowing currents than in accelerating efflux; and it is only in very dry and highly heated region such as India, that they produce well marked diurnal surface winds blowing outwards towards the sea; winds of elastic expansion, such as are the hot

* Excepting of course in the immediate neighbourhood of the coast, when the sea breeze of the lowest stratum is a secondary effect of the outflow.

c. Barakur group, with which the
d. Talchir group—is in closest relation.

Thus stands now our knowledge of the relations and conditions of the Damúdas, in which of course our Raniganj coal-field is included.

The flora—the only remainder of former life—of that Damúda series will be worked out as a whole later on. But in the meantime some shorter papers may illustrate certain groups of fossils which are contained in collections other than those of the Geological Museum.

Of such papers the present is the first, and the fossils were collected by Mr. Wood-Mason.

First of all I will give a list of the fossils found by Mr. Wood-Mason, then the descriptions, amongst which I also include short notices of such fossils as occurred in the Raniganj field, but were not found again by Mr. Wood-Mason.

I. List of the Fossil Plants brought by Mr. Wood-Mason from the Raniganj Coalfield.

Palæontological System.	References to Plates.	Living affinities.	Remarks.
I. Equisetaceæ.			
Sphenophyllum Trizygia (Royle.) Ung., ...	Pl. XV, 1. 2.	Equisetaceæ.	Different from all palæozoic species.
Vertebraria indica, Royle, ..	Pl. XV, 3. 4. XVI. 4.	Equisetaceæ.	Rhizomes? and rootlets.
II. Filices.			
1. *Sphenopterides.*			
Sphenopteris polymorpha, Fstm., ...	Pl. XVI, 5-7. Pl. XVII.		
2. *Pecopterides.*			
a. Group of Alethopteris Whitbyensis (Schimp. 1869; Fstm. 1876.			
Alethopt. Lindleyana, Royle,	Pl. XX. 7.	?	Fructificating specimen.

Palæontological System.	References to Plates.	Living affinities	Remarks.
Alethopt. cmp. Whitbyensis Göpp., ...	Pl. XXI. 6, 6*a*.	Pteris ?	In the form of Pecopt. tenuis, Bgt.
b. Type *Phegopteris.*			
Alethopt. phegopteroides Fstm., ...	Pl. XVIII.	Phegopteris decussata, Mett.	A new form of fossil ferns.
3 *Taeniopterides.*			
Macrotæniopteris danæoides, Royle sp.	Pl. XIX. 1, 2. Pl. XXI. 1.	Acrostichum ?	Mezozoic.
Macrotæniopteris sp.			
c. Type *Vittaria.* *Gen.—Palæovittaria*, nov. gen 1876.			
Palæovittaria Kurzi, Fstm. ..	Pl. XIX. 3, 4.	Vittaria.	New genus.
4 *Dictyopterides.* *Gen.—Belemnopteris*, nov. gen. 1876.			
Belemnopteris Wood-Masoniana, Fstm.	Pl. XX. 1, 2.	Gymnogrammæ sagittata Ettgh. (Hemionitis cordata, Rxbgh. Pteris sagittata, Raddi.	New genus.
Genus Gangamopteris, McCoy, 6.			
Gangamopteris Whittiana, Fstm.	Pl XX. 3, 4.	Antrophyum latifolium, Bl.	New form.
Genus Glossopteris, Bgt. 1828.			
Glossopteris angustifolia, Bgt.	Pl. XXI. 2, 4.	Pteris ? Schizoloma ?	Exhibiting a marginal line.
Glossopt. communis, Fstm. ..	Pl. XXI. 5.	?	
Genus Sagenopteris, Bgt. 1828.			
Sagenopteris polyphylla, Fstm.	P. XX. 5, 6.	?	Glossopteris acaulis McCl.

II. Descriptions of the Plants from the Raniganj field.

The specimens brought by Mr. Wood-Mason represent two orders only: I. *Equisetaceæ* and II. *Filices.*

The specimens are almost all very well preserved in a dark grey shale, and are throughout covered with a very thin film of coal, the former vegetable substance. In this respect they differ from the most of the specimens from Raniganj in the Museum of the Geological Survey, these being mostly in a light grey rock, and only rarely covered with a coal-

film. It seems that Mr. Wood-Mason's plants are from a different clay-band.

In the description of the fossils I will always first discuss those brought by Mr. Wood-Mason, which are mostly figured, briefly mentioning the other plants known from the Raniganj field.

1. *EQUISETACEÆ.*

Fossil *Equisetaceæ* are known to occur throughout all the sedimentary rocks from the Devonian unto the present time. But I think this is so with the greatest portion of fossils, and has no consequence as to the possibility or impossibility of determining the age of a certain group. There are always certain differences which enable us to use a fossil organism, although it has some or very close relation in the present world, as a guide in determining the age.

So it is with the *Equisetaceæ* too; each of the formations has its peculiar forms, some of which have more or less perfect representatives in the living *Equisetum*, having a complete spathe in the *articula* of the stalk, while some others have no longer any existing analogues.

As far as I can say the peculiar forms are just in those epochs, wherein the *Equisetaceæ* are most richly developed, as in the palæozoic and mezozoic epoch (here especially in the Trias).

The palæozoic epoch is chiefly characterized by the following :—

a. *Calamites*, Bgt.
b. *Asterophyllites*, Bgt.
c. *Macrostachia*, Schimp.
d. *Cinyularia*, Weiss.
e. *Sphenophyllum*, Bgt.*

The mezozoic is marked by the following peculiar genera :—

a. *Schizoneura*, Sissimp.
b. *Phyllotheca*, Bgt.
c. *Sphenophyllum*—a peculiar form.
d. *Vertebraria*, etc.

The genus *Equisetum* of the fossil Flora agrees, as I have already said, with living forms; and some forms which one takes as *Calamites* are certainly casts, and perhaps sometimes stalks of other *Equisetaceæ*, as well as the lower carboniferous genera *Stigmatocanna*, *Anarthrocanna*, etc., are nothing but forms of *Calamites* with scars disposed in regular arrangement.

* *Sphenophyllum* has long since ceased to be peculiar to the carboniferous epoch, as we know it from Permian and also from the Triassic Damúdas.

I think some of these *Calamites*-like forms also occur in our Damúdas, but are generally termed *Phyllotheca.**

Genus **Sphenophyllum,** Bgt. 1828.

Plantæ herbaceæ; caule ramoso, ramis alternantibus aut oppositis. Caule primario crassiore, secundariis tenerioribus, interdum tenerrimis, ad articula inflatis, costatis, costis non alternantibus; internodiis in longitudine variantibus.

FOLIIS CUNEATIS, *sessilibus, plurime in articulis verticillatis, interdum alio in modo dispositis; in numero variantibus, numerum duodecim rarius attingentibus; marginibus lateralibus integris, margine exteriore saepius dentato aut vario in modo inciso.*

NERVO MEDIO NULLO, *sed nervulis pluribus, æqualibus, ex nonnullis crassiusculis repetito dichotomis. Fructificatio spicaeformis.*

This diagnosis, originally drawn up for the *Sphenophyllum* of the palæozoic epoch, I have completed so as to make it applicable also to our Damúda forms.

For in general this genus was formerly considered as characteristic of the true carboniferous formation. But later it was discovered in other portions of the palæozoic epoch also.

Dawson† mentions a *Sphenophyllum* from the Devonian in Canada; I know *Sphenophyllum* from the Culm in Silesia, and another specimen from the Permian, in the so-called Schwarte, in the Rakonitz coalfield in Bohemia and from Stepanitz near Starkenbach (Bohemia), and, finally, from the passage-bed between the Carboniferous and Permian in the so-called "Núrschan-Gasschiefer" from the Pilsen-coalfield in Bohemia‡; so that the genus is now known from all members of the palæozoic epoch. But it is also known from higher beds.

This genus is easily recognised by the shape of the leaves. These are cuneiform, sessile in the articulations of the stalk (therefore in numerous whorls on the stalk), entire on the lateral margin, but may be dentate or incised in various ways on the exterior margin. The veins are also peculiar: there is no midrib, and although the veins are numerous, they

* In this form the *Phyllotheca* belongs certainly to a great extent to *Schizoneura*, Sch.

† Dawson on the Flora of the Devonian Period in North Eastern America, Q. J. Geol. Soc., Vol. XVIII, pp. 296—330, Pls. XII—XVII; and on the fossil flora of the Devonian and Upper Silurian in Canada. London 1871. 20 Plates.

‡ Feistmantel, Ueber den Nürschaner Gasschiefer, etc. Zeitschr. d. D. geolog. Gesellschaft. 1873.

pass out from the base as two or more main-veins and spread out in the leaf surface repeatedly bifurcating.

The stalk, which as I have mentioned, is articulated, is rarely striated on the surface; the internodes are of different lengths.

As regards the nature of this genus and its relations, it was first described as belonging to the *Marsileaceae** by Brongniart; Lindley and Hutton† considered it to be one of those plants which in the ancient world represented the pine tribe of modern floras.

Mr. Unger in 1845‡ also placed *Sphenophyllum* with the *Marsileaceae,* while in 1850§ the same author ranged it with the *Asterophylliteae,*‖ placing this order, together with the *Equisetaceae* and the *Calamiteae,* in the class *Calamarieae;* and from that time until Schimper's 'Palæontologie végétale' appeared in 1869 we find *Sphenophyllum* (as a peculiar genus) generally ranged with the *Equisetaceae.*

I think it would be quite unnatural to consider it as belonging to the *Marsileaceae,* as there in the whole world amongst all the *Marsileaceae* is not a single form which has more than one leaf-whorl coming out from the rhizome on a thin stalk, which is never articulated.

Some years ago, however, Mr. Carruthers¶ endeavoured to unite not only *Asterophyllites,* Bgt., with the genus *Calamites,* Bgt., as leaved branches of it, as Mr. Ettingshausen** had already done, but also the genus *Sphenophyllum,* Bgt., although this last is so characteristic.

But quite recently we have some further investigations about this genus by Mr. Williamson†† and by Prof. Renault.‡‡

The latter author would prove that *Sphenophyllum* cannot possibly be an equisetaceous plant, just what Mr. Williamson had attempted to show in the case of *Asterophyllites;* and both these authors would have us believe that *Asterophyllites* and *Sphenophyllum* are very closely allied genera and more closely allied to lycopods than to any other plants. A communication on this subject in the above-mentioned sense I have in a letter of Mr. Williamson (1875).

* Brongniart, Prodrome, 1828 p. 68. Royle, l. c. p. 431. XXIX.

† Fossil Flora of Great Britain. Vol. I. 1831-33. pp. 41-44, 86.

‡ Synopsis plant. foss. pp. 112-114.

§ Genera et spec. plant. foss. p. 69 seqq.

‖ Including *Volkmania, Huttonia, Asterophyllites, Annularia,* etc.

¶ The cryptogamic forests, Geolog. Magaz, 1868.

** Haidingers Naturwissenschaftl. Abhandl. 1851. Flora der Steinkohlenformation von Radnitz. Abh. d. K. K. Geol. Reichsantst. 1852.

†† Philosophical Transactions, 1874. p. 41 seqq., Pls. I—IX.

‡‡ Researches sur l' organisation des Sphenophyllum et des Annularia, Mem. del Acad. des Science. Paris. 1870.

Already at that time this author supposed that the leaflets of *Sphenophyllum* could have been produced by coalescence of leaves of the genus *Asterophyllites*, just as in *Equisetum* and in *Schizoneura*, wherein the spathes or portions of the spathes are produced by the junction of several leaflets; but in the latter genera we find the spathe traversed by simple veins only, representing the same veins as were in the separate leaflets before these grew together.

In *Asterophyllites* also we have undivided veins in the leaflets. *Sphenophyllum*, however, has repeatedly forked veins: invariably two or more main veins, originating at the base of the leaf, are continually forked until they reach the margin, so that from the two main veins we can have as many as 20—30 forked veins reaching to the margin in one leaflet.

But that which Mr. Williamson three years ago advanced as a supposition only he brought forward as an established fact before the last meeting of the British Association at Glasgow,* saying that the wedge-shaped leaves of *Sphenophyllum* are merely the result of the coalescence of several of the leaves of *Asterophyllites*.

The learned author, who at that meeting expressed also his "strong conviction† that the flora of the coal-measures would ultimately become the battle-field on which the question of evolution with reference to the origin of species would be fought out," will certainly excuse me, taking especially our Indian *Sphenophyllum* into consideration, for entertaining some doubts as to the close relationship of *Sphenophyllum* and *Asterophyllites* in the above-mentioned sense.

As our figure (Pl. XV, Fig. 2*a*) plainly shows, the veins of our *Sphenophyllum* pass out as two main veins and are forked in a regular way until they reach the margin. Here no coalescence of leaflets is possible, least of all of *Asterophyllites* where the leaflets have only one undivided midrib.

Further, everybody knows very well that the leaflets of *Asterophyllites* are linear and attenuated both towards the base and towards the apex, so that they could never produce by their coalescence a wedge-shaped leaf, with the broadest portion just at the apex as in *Sphenophyllum*.

Our *Sphenophyllum* shows this further to be quite impossible by the arrangement of the leaf-whorls in the *articula*, as we always find quite regularly three pairs of leaflets, of which one pair is smaller than the others.

The stalk also is generally thinner in the genus *Sphenophyllum*, our Indian form showing this very evidently.

If the leaflets of *Asterophyllites* were to grow together, they would

* I have read the report published in Nature for 21st September, 1876, No. 360, p. 455, the only one which has as yet reached us.

† Ibidem, p. 456.

form either a dentate upright spathe or an oblong-oval leaf, which, however, would also be upright in the manner seen in *Equisetum* and *Schizoneura.* In the latter genus there are generally two spathe-portions, which are oblong-oval and contain as many distinct simple veins as leaflets have grown together; in some cases we see the leaflets separated again by dehiscence, but they could never produce anything like the leaf of *Sphenophyllum*, in which also the forked veins afford a chief difference.

I am much inclined to believe that both genera have the same microscopical structure and belong to the same order; but I think it is against all morphological and biological laws to suppose that linear leaflets, which are attenuated at both ends and all contain invariably only one undivided rib, could ever by their coalescence produce a wedge-shaped leaf, with a narrow base and a disproportionally broader apex, and with 2 or 3 chief veins, which are repeatedly forked to the margin.

All these relations, together with the much thinner stalks and a different fruit-spike, will, as I think, still maintain *Sphenophyllum* as a peculiar genus belonging, with *Asterophyllites,* to the same order; but that this is that of the *Lycopodiaceae*, must, as I think, be thoroughly proved* before one can draw any conclusions.

But for the present I think it is better to leave them both in the class *Equisetaceae*, when following Schimper's system, we have :—

Class :—Equisetaceae.†

Order I.—Equiseteae, true horsetails.

E q u i s e t e u m, Linn.‡

S c h i z o n e u r a, Schmp.§

Equisetides, Schmp.

P h y l l o t h e c a, Bgt.||

Order II.—Calamarieae.

Calamites, Suits.

Asterophpllites, Bgt.¶

Fruit-spikes.

S p h e n o p h y l l u m, Bgt.

Annularia, Bgt.

Schimper does not mention the *Sphenophyllum* from our Damúdas at all; and his diagnosis, therefore, as referring only to the palæozoic

* While this paper is passing through the press, I have heard that Mr. Stur of Vienna proves that *Sphenophyllum* cannot by any possibility be a Lycopod.

† The Indian forms are spaced.

‡ None in Damudas; one species in the Rajmahal Hills.

§ Very abundant in the Raniganj group and in Trias in Europe.

|| Very frequent also in Italian Oolite.

¶ Schimper uses *Calamocladus*, Schimp.

species, is not quite complete; and hence it is that he speaks only of forms with complete leaf-whorls in which all the leaflets are equal.

But from my more complete diagnosis is seen that there can be distinguished two groups as regards the arrangement of the leaves.

1. *With complete whorls.*

This group would include the palæozoic forms.

2. *With incomplete whorls.*

In this I place the Triassic forms of our Damúdas. A case analogous to this we will find in *Neuropteris*, Bgt., wherein the bi- and tri-pinnate fronds belong to the palaeozoic epoch, while the single-pinnate forms occur in the Trias.

SPHENOPHYLLUM TRIZYGIA, Ung., Pl. XV, Figs. 1, 2, 2a.

1839. *Trizygia speciosa*, Royle, l. c. p. XXIX. p. 431, Pl. 2. f. 8.
1845. ———————, Unger Synopsis. plant. foss. p. 114.
1850. *Sphenoph. speciosum*, McClell., Report, p. 54. Pl. XIV. f. 5.
1850. *Sphenoph. trizygia*, Ung., Gen. et. sp. pl. f. pag. 71.
1860. *Sphenophyllum*, T. Oldham, M. G. Surv. II. p. 316.
1865. *Trizygia*, W. T. Blanford, Raniganj coal field M. G. S. Ind. III. p. 31.
1876. *Sphenoph. Trizygia*, Feistmantel, Notes etc., Rec. G. S. I. IX. 3. p. 70.

Caule articulato, tenerrimo, fluctuante (?) ; foliis senis in articulis, totum verticillum haud formantibus, sed unilateraliter in tria paria dispositis ; pare summo longissimo, imo brevissimo minimoque, medio mediocri. Foliis obovato-oblonge cuneiformibus ; NERVO MEDIO NULLO, *nervulis crebris aequalibus* EX DUOBUS *primariis regulariter dichotomis.*

Stalk articulate, very slender, floating (?) ; the leaves by six in each articulation, not forming a complete whorl, but disposed on one side of the articulum in three pairs ; the uppermost pair the longest, the lowermost the smallest ; the leaflets oblong-cuneiform, ; no midrib, but the veins numerous, equal, regularly dichotomous out of two chief veins.

Of this interesting species Mr. Wood-Mason has brought several nice specimens, of which I figure two, to show the different sizes, the lower leaflets being much longer than the upper ones.

The collections of the Geological Survey contain also a great many specimens of this species; and other figures will be given in the 'Palæontologia Indica'.

This species was first discovered by Mr. Royle and figured and mentioned as *Trizygia speciosa ;* with this name we find it still in Unger's Synopsis (1845) and in the Mem. G. S. India. But McClelland in 1850 and Unger also in 1850 placed it with *Sphenophyllum*, Bgt., the former keeping the older specific name, *speciosum ;* the latter substituting *trizygia*

for it, which I adopt too, as it shows that the species belongs to the genus *Sphenophyllum* and has the leaves in three pairs *(trizygia)*, while it at the same time recalls Royle's generic name.

That the fossil under discussion belongs to *Sphenophyllum* cannot, I think, be doubted, as all the characters of the stalk and of the leaves agree well.

But it has a very characteristic peculiarity in the leaves, which is constant in all specimens hitherto found: it is that there are in all specimens only six leaflets in each *articulum*, forming three pairs of different lengths and sizes, arranged on one side of the articulation. The leaflets are entire; the veins are very numerous in the broad portion of the leaflets; they begin as two main veins, which are forked at almost equal distances dichotomously, until one can count 18—20 at the apical margin; some of them, especially those on the lateral margins, are continued undivided after the second or third furcation.

By this condition of the leaves, our species differs totally from all palæozoic forms, and is not at all opposed to the view of a mezozoic age for the Raniganj group; and thus the division of this genus into two groups is quite justifiable.

But there is another circumstance which renders this fossil important.

It was formerly known only from Raniganj, and McClelland's specimens came from that locality. But later it occurred also at Talchir (Cuttack) in Orissa, in a dark sphærosideritic shale. These beds near Talchir and Cuttack had hitherto been ranged with the lower portion of the Damúdas or the Barakúr group.

The specimens from the Raniganj and Barakur group represent the same species, only in the latter they are generally of slightly smaller size.

We have, therefore, in *Sphenophyllum trizygia* already one typical species which is common to the upper and to the lower portions of the Damúdas.

Lately Mr. Schenk* described a form from the Wealden as *Marsilidium speciosum;* but if I see aright, this form also exhibits two whorls of leaves in the articulations of the stalk, and it would have been more natural to have ranged it with *Sphenophyllum*, as it is well known that no known *Marsileaceae* have more than one whorl of leaves.

Besides the *Sphenophyllum trizygia*, Ung. there are known from the Raniganj coalfield other important forms belonging to the *Equisetaceae*, which I cannot omit to mention, but of which I give only a few figures,

* Fossile Flora der Wealdenformation; Palæontographica, Cassel, 1871, p. 225. Pl. XXVI, Fig. 3.

because no representatives of them are amongst Mr. Wood-Mason's specimens, and because those from our collection will be hereafter figured sufficiently in the 'Palæontologia Indica.'

Genus **Schizoneura**, Schimp. 1844.

This very peculiar genus was established by Mr. Schimper*. It was formerly known only from the Trias, of which formation it is especially characteristic; Schimper† having only recently placed the Rhætic *Calamites Hoerensis*, Hss.‡ in this genus as *Schizoneura Hörensis*, Schimp.; so that this author can well say (l. c., p. 282), "*Le génre Schizoneura characterise le Trias et les couches Rhétique.*"

The species of *Schizoneura* known at present are:—

Schizoneura paradoxa, Schimp. (l. c.), from the Upper Grés Bigarré (Lower Trias) in the Vosges.

Schizoneura Meriani, Schimp., from the Keuper near Stuttgart, Salz-sur-le-Necker, etc.

Schizoneura Hoerensis, Schimp., from the Rhætic at Hoer in Scania, Salzgitter in Hanover, etc.

This genus is a very characteristic one. It has an articulated stalk or stem; the originally separate leaflets are grown together into a spathe, which, however, attains a much greater length than the internodes and consequently bursts generally into two pretty equal portions, each containing as many pretty thick ribs as there are leaflets grown together. Owing to the original form of the leaflets (narrower at base and towards the apex), these two portions have an oblong oval shape and are always directed upwards. Sometimes the dehiscence goes further still, so that we find one portion of the spathe only entire and the other split into several leaflets, or even both portions are resolved into leaflets.

In our Raniganj group this genus is very abundantly represented, especially at Raniganj, specimens from which locality have been for many years (16) in the collections of the Geological Survey. But up to date neither figures nor descriptions of it have been published.

It is simply mentioned as *Schizoneura* in the Mem. G. S. India. Lately§ I examined the specimens and found the species identical with that in the Panchet group. I established it therefore as follows:—

* Schimper et Mougeot, Monogr. d. plant. foss. du grés bigarré 1844, pp. 48—51, Tab. XXIV—XXVI.

† Pal. vegét. I, p. 283.

‡ Hiesinger, Lethea Suec. Supp. II, p. 5, Tab. XXXVIII, Fig. 8.

§ Rec. G. S. Ind. IX, 3, p. 69.

Schizoneura gondwanensis,* Fstm., Pl. XVI, Figs. 1—3.

1876. Feistmantel, Rec. Geolog. Surv. Ind. IX, 3, p. 69.

Trunco articulato ramoso, caule† articulato, striato, variabili altitudine ac latitudine, foliolis 12—22, plerumque duas in partes vaginae coalitis, nonnunquam etiam liberis suberectis; foliis (partibus vaginae) oblonge ovalibus, usque ad 14·5 cm. longis et media in parte 2·5 cm. latis; 7—11 nervos (singulorum foliorum) continentibus.

On this species I will here make only a few short remarks, as full details will be given later on.

a. It is very closely allied to *Schizoneura paradoxa*, Sch. M.,‡ the only difference being that our species has the portions of the vagina broader and has therefore more veins (indicating the leaflets which by their coalescence have formed the vagina).

b. As in *Schizoneura paradoxa* the portions of the spathe are sometimes found burst into the original leaflets: and thus we find it in our Raniganj species, but more frequently with only the apex of the spathe split as indication to further bursting; in our figures two leaflets (figs. 1 and 2.) exhibit this state, and on a future occasion I will illustrate this further.

c. *Schizoneura paradoxa* is a typically Triassic fossil. We may, therefore, consider our species also as Triassic.

d. The Damuda species is not different from that in the Panchet group, which latter I have also designated *Schizon. Gondwanensis.*§

e. It occurs, therefore, in both members of the lower portion of the Gondwana system, and from this circumstance I derived the specific name.

f. No *Schizoneura* is as yet known from Australia‖ with certainty, and to consider the genus *Zeugophyllites*, Bgt.,¶ as *Schizoneura*, as Messrs. T. Oldham** and H. F. Blanford†† have done, would be merely a supposition, as every one must recognise at once and that very easily the great difference between these two fossils. It is also incorrect to consider, as Mr. W. T. Blanford‡‡ has done, the Australian *Nöggerathia* as ? *Schizoneura*, the two latter genera being quite as distinct as the two

* I give here only 3 little figures as all the other specimens will be figured in the Flora of the Damuda Series in the *Palæontologia Indica.*

† *Foliifero.*

‡ L. c. pp. 50, 51. Pls. XXIV—XXVI.

§ R. G. S. Ind. IX. 3. p. 66.

‖ I mean from the lower coal-measures, in which marine fossils predominate.

¶ Prodrome 1828, pp. 118-121; Streleczki, Phys. Descript. of New South-Wales, 1845.

** M. Geol. S. Ind. II, p. 327.

†† Q. J. G. Soc. 1875, p. 527.

‡‡ Rec. G. S. Ind. IX, 3.

former are from one another; and I think certainly that Mr. W. B. Clarke would be able to distinguish a *Nöggerathia* from a *Schizoneura* or *vice versâ.**

My opinion about the Australian *Zeugophyllites* is that it is rather a *Zamieae,* as it differs in its chief characters from *Schizoneura.*

This latter has, owing to the coalescence of the leaflets into a common spathe, or after the dehiscence of the one spathe into two portions, much thicker veins, the representatives of the midribs of the originally separate leaflets, and the veins are also much more distant and all of equal thickness, while *Zeugophyllites*† has many more veins, which are the venation of the leaf itself, this being plainly rather a single leaf than the result of the coalescence of several leaflets.‡

I would consider it as belonging to the genus *Zamites,* Bgt., or perhaps also to some of the *Podozamites;* these genera are all mezozoic.

In a paper by Mr. Bronn on the Triassic flora of the Raibler Schiefer,§ on pl. vii. fig, 4, is figured a specimen which is tolerably like the Australian *Zeugophyllites*, only that the veins are a little thicker.

Schizoneura and *Zeugophyllites* are therefore substantially quite different, the latter being a single leaf, the former having leaves formed by coalescence of several leaflets.‖

Schizoneura is especially known from the Raniganj field, Jheria coalfield, but almost in the same abundance also from the Nerbudda valley (upper Denwa valley near Barkundum). In the flora of the Damúda group many specimens of this genus will be figured.

Genus **Phyllotheca**, Bgt. 1828.

1828, Brongniart Prodrome, 1828, p. 151.

The systematic position of this genus is, as I think, in the *Equisetaceae,* as the leaf-spathe plainly indicates. I do not see anything uncertain about it.

The most characteristic forms of this genus are known from the Italian Oolite.

* From specimens which I have seen from Australia I have satisfied myself that the Australian *Nöggerathia* is certainly a *Nöggerathia* in the same sense as *Nögg. Hislopi*, Bunb. Schimper considers *Zeugophyllites* to be a *Cycadeaceae.*

† In my note on the Damuda Flora, R. G. S. India, IX. 3, p. 69, 4 lines from below, after the words "seem to belong also to *Schizoneura*" the words "according to Mr. Oldham" have been omitted, as can be seen from the following sentence, wherein I plainly say "that I do not know anything like *Schizoneura* from the lower coal-strata in Australia."

‡ Streleczki, l. c. p. 250, Pl. VI, f. 5.

§ N. Jahrb. f. Min. etc. 1858.

‖ Dana (U. S. Explor. Exped., Geology, p. 715) refers *Zeugophyllites* to *Nöggerathia.*

The first specimen was described by Ad. Brongniart,* from Australia; it was the *Phyllotheca australis*, Bgt.; later, Mr. McCoy added the *Phylloth. ramosa* and *Ph. Hookeri*,† which, however, seem not to be different. Subsequently Sir Ch. Bunbury described the *Phylloth. indica* from the Nagpur District,‡ and later still Mr. de Zigno§ described complete specimens from Italian Oolite.

No forms like these are known from true coal-measures anywhere.

This genus has, therefore, its analogues as well in the upper Australian coal-measures as in the Italian Oolite.

The Australian *Phyllotheca* resembles the Italian forms most wonderfully.

From India the real *Phyllotheca indica*, Bunb., was formerly only known from the Kamthi group|| (Nagpúr district).

But only lately I succeeded in discovering a specimen of *Phyllotheca*, Bgt., in the real sense in our Raniganj collection; it is identical with the Kamthi species, and is further evidence that both these groups belong to the same horizon.

Although our *Phyllotheca* at first sight seem very near some from Australia, they are yet distinct from them in the mode of formation of the leaf-spathe in the *articula;* our specimens having generally much thinner, and therefore more numerous leaflets, which are not grown together into so long a tube (spathe) as in some of the Australian specimens, the leaflets of which are generally broader: in which respect they agree more with those from Italy: the spathe is also longer.

Incertæ sedis.

Genus **Vertebraria**, Royle, 1839.

Pl. XV, Fig. 3, and Pl. XVI, Fig. 4.

Amongst Mr. Wood-Mason's specimens is also numerously represented that form which is so common throughout the whole Damúda Series, and which was first called by Royle *Vertebraria*, but the true nature of which has not been satisfactorily made out to date.

Dr. Royle¶ mentions this fossil only, without any description. He distinguished two species, which I do not consider to be different. The one called *Vertebr. indica* is the more common type.

* Prodrome 1828, pp. 175, 152.

† A. and M. N. H. 1847, pp. 155-157.

‡ Q. J. G. Soc. XVII. p. 355, Pls. X. XI.

§ Flor. form. Oolith. 1856—1868. (Only these fascicles are in my hands.)

|| Most of the other specimens which are mentioned from elsewhere as *Phyllotheca*, especially from the Raniganj field, and which represent mostly stalks and stems, belong, as I think, to the genus *Schizoneura*, Schimp., as stem portions, the real *Phyllotheca*, Bgt., being rather rare.

¶ Illustr. Bot. etc. Him. Mount. 1839, p. 29. Pl. II. 1. 2. 3. 4. 5.

The first discussion of this genus we find in McCoy's paper on the fossil botany and zoology, &c. of Australia,* wherein the author especially describes *Vertebr. Australis*, McCoy, which is something like Royle's *Vertebraria radiata* from India. But as both species were founded on very insufficient materials, and as the figure in McCoy's paper is the only existing one, it would be rather hazardous to draw any conclusions; and yet generally the Australian *Vertebraria* has both by Mr. Oldham and by Mr. W. T. Blanford been taken as identical with our Indian one.†

McCoy considered his specimen to be very near to the genus *Sphenophyllum* as a form with very short internodia, so that the leaf-whorls are very approximate. It is true that it looks at first sight a little like it, but I think it to be altogether an accidental preservation of the common form.

From this consideration Mr. Unger quoted the forms of *Vertebraria* as *Sphenophyllum;* and from this consideration of McCoy and determination of Unger I think it has happened that there is mentioned from Australia also the genus *Sphenophyllum*, no specimens of which have ever been described or figured from that country.

The next discussion of *Vertebraria* is to be found in Bunbury's paper on the fossil flora of Nagpúr,‡ wherein the author speaks especially of his figure l. c., Pl. XI. 3, of which he plainly says that it cannot be either *Sphenophyllum* or any one of the *Asterophylliteae*; but that it appears to him rather to be the roots of some large plants, and so he concludes—

"On the whole, then, I am of opinion that the branched specimens from Kamthi, which have been taken for *Vertebraria* were the roots of some plants, possibly of *Phyllotheca*,§ Bgt., that they had probably a woody central axis of small diameter, that between this axis and the outer coat or rind there was a hollow, traversed at irregular distances by incomplete partitions, which connected the outer coat with the axis.

"The unbranched specimens were most likely also fragments of root, though it is not quite so clear." This is the extent of our knowledge of this peculiar genus.

I think I will presently be able to make some further remarks about this genus, especially about the unbranched form. Such specimens are well represented in Mr. Wood-Mason's collection; they are mostly pretty large, but some of them are branched too, but in a way other than in the specimen discussed by Sir Charles Bunbury.

* A. and M. N. H. Vol. 20, 1847, pp. 145-147.

† I have a good, pretty large specimen of *Vertebraria* from Australia (Bowenfells upper coal-measures) before me which is totally different from our forms. As yet *Vertebraria* is quoted only from the upper coal-strata.

‡ Q. J. G. Soc. XVII, p. 338.

§ In Nagpúr it is very likely so, as there *Phyllotheca* (in the true sense) occurs plentifully, while in the Raniganj field it can belong to another genus.

The most instructive specimen is that which I have figured (pl. xv, fig. 3.), and it will be sufficient first to discuss this.

It represents a thickish stem with a branch passing out of it.

The stem appears at first sight to be of the same kind as Royle's* *Vertebraria indica*, but our specimen has the "middle axis," if one can so call it, broader. The whole stem shows the seemingly irregularly disposed 'breakings' on both sides of the axis, but a closer inspection shows that they are not so irregular.

The only difficulty of observation is that the specimens are generally very much crushed and have the outer coat destroyed, but the one under discussion is better preserved than most others.

The most important point about this specimen is that the whole surface is regularly longitudinally ribbed, in the same manner as the fossil *Calamites* or *Equisetum;* the ribs are rather broad, on the average about 2 mm., and are separated by thick lines (or very thin ribs, as one may call them), in the same way as is seen in some *Calamites* of the coal-measures.

The ribs are in general continuous over a long portion of the stem, but on some of the 'breakings' there are apparently interruptions of the ribs; the ribs ending regularly in the 'breaking' and the next ribs beginning again independently.

This reminds one very closely of the formation of an articulation in a *Calamites* or, indeed, in the *Equisetaceae* in general, and I consider it as representing an articulation. Our figure (pl. xv, fig. 3, *a. a. a.*) exhibits these relations very well.

So far they would agree completely with *Calamites* or *Equisetum*, and as regards the breadth of the ribs, mostly with some of the Triassic forms.

In these articulations the ribs do not alternate, as they generally do in the carboniferous *Calamites*,† but are arranged as they almost always are in the Triassic forms.

From what I have said about this stem, I am quite certain that it belongs to the *Equisetaceae* or at least to some order in which the *Calamites* must be placed; which is shown by the ribbed surface and by the articulations. But how to explain the 'breakings' of the stems? They are not so irregular as they seem to be at first sight. One thing is certain, that the articulations which I have observed on our specimen are just in the 'breakings'; perhaps this genus was very fragile at the articulations; but Sir Charles Bunbury's hypothesis could be right too.

Yet another circumstance must be mentioned, which is of importance and could partly explain the 'breakings'. Our specimen is also branched;

* l. c. Pl. 2. f. 1.

† In the true Carboniferous I know of only one instance where the ribs do not alternate; it is in the coal formation of Silesia.

but the branch does not grow out from the body of the stem, being inserted in an articulation, or at least in a 'breaking', and being joined to the main stem by an articulating surface (pl. xv, fig. 3, b.) in the same way as in *Calamites*, and in the *Equiseta*, fossil and living. The branch shows the same structure as the main stem, a central axis (?), the 'breakings,' and the striation of the surface.

I suppose this insertion of branches by a special articulation could produce in a certain way of preservation foldings or breakings similar to those seen in this specimen.

But still something must be considered. It is known that the rhizomes in living *Equiseta* are constructed in nearly the same way as the stems above the surface, but that, when they dry, they contract and shrink in different degrees. Our specimen could very easily represent such a state of things.

Another specimen of importance is that figured on pl. xvi, fig. 4.

It is a thin, compressed stem, which is preserved with the surface, as no axis is visible, but the characteristic 'breakings' and contractions are pretty well marked, so that nobody can deny its being a true *Vertebraria*, Royle; but what is interesting in this specimen is, that the 'breakings' and contractions are quite regular, corresponding with the articula and internodes of equisetaceous plants. One can count 9 internodes and therefore 8 articula, which are pretty much of the same length. The articula are well marked by a constriction and a 'breaking' in both adjoining internodes.

The surface is smooth, but on the right side (of the figure) of the original specimen are seen in all the internodes several ribs, which seem to be interrupted in the place of the constriction, and thus to form an articulation similar to that which I have already described in the other specimen.

I can therefore draw, as regards the specimens before me, the following conclusions:

1. *Vertebraria* was most probably the rhizome of a certain equisetaceous plant.

2. This is rendered probable by its very frequent occurrence throughout all the strata of the Damuda series in an almost unaltered appearance—further by the regular striation or ribbing of the surface and the partially preserved articulation.

3. Some of the "breakings" may have been produced by the insertion of branches in the articulations.

4. What now about the relations? there we are obliged to suppose that they belonged to some frequent plants. Here in Raniganj it is very easy to find the connection, where other equisetaceous plants are so frequent, especially *Schizoneura*, Schimp, to which most of the stems known here as *Phyllotheca* belong, as I think, as stalks above the surface.

We should therefore have *Vertebraria* as rhizome, *Phyllotheca** (those stems which are called by this name) as stalks, and *Schizoneura* as the leaved branches of one and the same plant.

5. But I think *Vertebraria* could have belonged as rhizome also to some other plants of other genera or species, and in the Raniganj field it could have belonged also to *Sphenophyllum*, in the Kamthis to the *Phyllotheca indica* (the real *Phyllotheca*).

6. In Australia, in the upper coal-strata, this genus belonged certainly to *Phyllotheca* too, as it is always associated with it, and no other Equisetaceous plant has hitherto been found with it.

7. But in some localities we do not find it associated with any plant to which it could be referred; which, however, is no proof against the suppositions I have just made.

Besides these complete specimens of *Vertebraria*, a specimen is in Mr. Wood-Mason's collection which more resembles that described by Sir Charles Bunbury: it is a branching specimen, which in reality seems to be a rootlet, as Sir Ch. Bunbury explained it; I have given a figure of it on pl. xv, fig. 4.

From other places we have better specimens of the same kind, in which the branching agrees exactly with Sir Charles Bunbury's description; and I will describe them hereafter.

The following table is given to illustrate the occurrence of Equisetaceæ in the Raniganj field :—

* The real *Phyllotheca* with a closed leaf-spathe is a peculiar genus.

III. General View of the Equisetaceæ in the Raniganj field.

Names of the Species from Raniganj field.	Where in other portions of the Damúdas.	Europe.		Australia.
		Trias.	Jura.	
Class Equisetaceæ.				
Order I. *Equiseteae.*				
Schizoneura Gondwanensis, Fstm.	Jherria coal-field. Danwa valley. Very frequent also in the Panchet group.	Genus: lower Trias in the Vosges. Keuper at Stuttgart		
Phyllotheca indica, Bunb....	Kamthi Beds (Nagpur district.)	....	Genus (real): Italy.	Genus in the upper coal-beds in New South-Wales; the same species also in Victoria, here with *Taeniopteris Daintreei*, McCoy, which in Queensland is characteristic of the mezozoic formation.
Vertebraria indica, Royle....	In all portions.	....	....	Genus in Australia.
Order II. *Calamarieæ.*				
Sphenophyllum trizygia, Ung.	In the Barákár group at Talchir in Orissa.	....	....	From Australia I have never seen a figure or any description.

II. FILICES.

The remains of ferns in the Damudas in general, and in the Raniganj beds in particular, were up to this time no rarity, on the contrary they occurred pretty frequently as regards specimens, but as regards variety of forms they must be considered to have been very poorly represented.

For only the genus *Glossopteris* occurred at all frequently, and this was the only fern formerly regarded as of any importance, because the other forms were of rarer occurrence.

But now we know that even amongst the older collections were other forms of importance, to which last year two others were added from Kurhurbali; and this year Mr. Wood-Mason has added a good number of interesting forms, all of which bear a mezozoic habitus, *Taeniopteris*-like forms and ferns with net-venation predominating.

The studies and works of the most illustrious palæontologists have shewn that the floras of the different epochs have in general special and distinctive characters, although these may not be so strictly limited as in the faunas, and although transitional forms are very often met with.

Thus we know that the coal-period in Europe and America, and the real lower coal-measures in Australia (Port Steffens, Smith's Creek, etc.), have their own flora, which is characterized by certain *Equisetaceæ*, and amongst ferns especially by the *Sphenopterides*, true *Neuropterides*, prevalent *Alethopterides*, *Lepidodendron*, *Cyclostigma*, *Sigillaria*, *Stigmaria*, etc. Forms with net-venation are rare, the true *Dictyopteris* and *Lonchopteris* being nearly the only forms of this kind and *Taeniopteris* being rare.

The mezozoic epoch, however, is especially marked by these forms with net-venation—forms generally different from the genera mentioned above from the true carboniferous: we find *Sagenopteris*, *Cheiropteris*, *Clathropteris*, *Camptopteris*, *Gangamopteris*; more numerous *Cycadeaceae*; frequently the order *Taeniopterides*, of different types; amongst the *Pecopterides* we find certain forms, of which many can be united into one group, of which *Alethopteris Whitbyensis*, Göpp., may be taken as the chief representative; and we find on the whole more numerous forms allied to living genera.

This, however, does not exclude the possibility of a genus like *Glossopteris* having existed in Australia at a time when carboniferous marine animals lived.

The ferns which Mr. Wood-Mason has brought are for the most part of such a nature that one can point with probability to their living allies.

I will not here speak more in detail of the ferns, as I have entered fully into the subject in my Kach and Rajmahal flora in the 'Palæontologia Indica,' and will only indicate the palæontological order of ferns, in which I will discuss them; the best and latest system is to be found in Schimper's 'Palæontologie végétale' and is as follows:—

Order I.—*Sphenopterides*.
" II.—*Neuropterides*.
" III.—*Pecopterides*.
" IV.—*Tæniopterides*.
" V.—*Dictyopterides*.
Genera adhuc viventia, etc.

Of these last I mention here only the order *Gleicheniaceae*, which is represented in the Rajmahal Hills.

Of these orders, I, III, IV, and V, are represented frequently enough amongst our Raniganj fossils, if we consider that the mezozoic epoch as a whole, especially the Trias, was rather poor in ferns, much poorer than the palæozoic epoch; we see, in Europe, that in the Trias, in comparison with the Permian and Carboniferous rocks, the forms are rather rarely represented. And so it is in India; and I think this circumstance, that is to say, the poverty in variety of forms, together with the very frequent occurrence of the genus *Schizoneura* and such characteristic fossils as a single pinnate *Neuropteris* (which is a Triassic type), the genus *Voltzia* with 2 species, *Albertia*, etc., can be used with far greater effect to bring our Damuda flora into contrast with the palæozoic flora, than the rarity of Cycads can to indicate a break between the lower and upper portion of the Gondwana system, both of which are closely allied by the mezozoic habitus of the flora in general.

In Australia the lower coal-measures with prevailing carboniferous marine animals must be taken as of that age, although some plants occur, which become more developed in the upper coal-measures, where only a flora is found which is not contrary to the supposition of a mezozoic age, although it cannot be well compared with our Damuda flora.

When I said that orders I, III, IV, and V, are especially represented amongst our ferns, I should have explained that these are only palæontological orders, which, however, are as well founded on certain characters as the living ones.

Botanists, it is well known, use the fructification, besides the venation, as a chief character in establishing their orders and genera. The former, however, being rarely found in fossil plants, the palæobotanist is obliged to use other constant characters, of which the venation and the shape of the leaf stand in the first place, and hence it is that in the same fossil genus (for instance, *Pecopteris*), we may find represented several living genera, which, however, cannot always be recognised, as only in a minority of specimens is the fructification preserved, while the typical venation of the genus *Pecopteris* will always be found indicated. The same we find amongst the *Taeniopterides*, *Dictyopterides*, etc.

Mr. Ettingshausen* published in 1865 a valuable work on living ferns, which is written for the special purpose of showing to what living types fossil ferns can be referred or which living forms are analogues of the fossil ones. In the present paper I shall have occasion to refer several times to this work.

* Die Farrenkränter der Jetzwelt etc. nach dem Flächenskelet bearbeitet; Wien 1865.

Order SPHENOPTERIDES (eæ.)

This order is especially developed in the carboniferous epoch, where we find forms with leaflets and fronds of the most different shapes.

The following genera have been distinguished—

Sphenopteris, Bgt.
Hymenophyllites, Bgt.
Trichomanites, Bgt.
Schizopteris, Bgt.

But there is no great difference between *Hymenophyllites* and *Trichomanites*, and we already find in Mr. Geinitz's 'Steinkohlen Deutschlands' some *Trichomanites* ranged with *Hymenophyllites*, also *Schizopteris* placed with the *Sphenopterides*. With this I perfectly agree, as I will show further on.

D. Stur (in Vienna) for a long time considered *Schizopteris* as belonging to the *Neuropterideae*.

The *Sphenopterides* have as their analogues in the existing flora the genera *Gymnogramme*, *Notochlaena*, *Cheilanthes*, *Davallia*, *Dicksonia*, *Aneimia*, etc.

Schimper, in his 'Palæont. végét.', used these living affinities to form as many subgroups of *Sphenopteris* as there are names of living genera analogous to it, as follows :—

Sphenopteris Gymnogrammides.
Sphenopteris Notochlaenides.
Sphenopteris Cheilanthides.
Sphenopteris Davallioides, etc.

Everybody will acknowledge this to be very reasonable, but it has only this one fault, that one is not always able to distinguish all the characters by which a species should be ranged with a particular subgenus.

Schimper distinguishes also a *Sphenopteris Trichomanides* and *Hymenophyllides*, which, however, are not far from each other, and which are better ranged with *Hymenophyllites*, Göpp.

For *Schizopteris* he establishes a new genus *Rhacophyllum*, as also separates some types formerly referred to *Sphenoteris* and places them in a new genus *Rhacopteris*, Schimp.

But some of these are certainly *Sphenopteris*, although Mr. Stur in a recent paper* again uses this name and places it with the *Ophioglosseae*. I, however, think it is much better to keep them with *Sphenopteris* too, and, following Mr. Schimper, to make a special subgroup of *Sphenopteris*, as they show a great affinity with this fossil genus and one otherwise would consequently have to place all the others in the living families also.

* Culmflora des Mährisch-Schlesischen Dachschiefers, Abh. der K. K. Geol. Reichsanstalt in Wien, 1875.

These have nothing to do with the *Ophioglosseae ;* I would mention only the two carboniferous* species, *Rhacopteris Asplenites* and *Rhacopteris Rakonitzensis*, Stur; the former is a real *Sphenopteris*, the other is certainly a *Zamieae* belonging to the genus *Nöggerathia* and has already been described as *Nöggerathia intermedia*, K. Fstm.

Some of those, however, which are placed in *Rhacopteris* with the other types of *Sphenopteris* are indeed different, and they should never be placed with them; they may have their affinities in the *Ophioglosseae*, as I will show especially on some specimens from Australia from the real lower coal-measures which certainly resemble *Botrychium* in the shape of the leaves.

From the Raniganj coal-field no *Sphenopteris*† has as yet been described, and I have not met with any specimen with certainty. Amongst Wood-Mason's specimens, however, are several, which on a closer examination turn out to belong to this genus.

Genus **Sphenopteris**, Bgt. 1828.

1828. Brongniart, Hist. d. végét. foss.
1841. Göppert, Gatt. foss. Pfl. I. p. 67.
1850. Unger, Gen. et Spec. plant. foss.
1855. Genitz, Verst. der. Sächs. Steinkohlenf.
1869. Schimper, Pal. végét. I.
1873. Feistmantel, Zeitsch. d. D. g. Gesell. 502. seqq.
1876. Feistmantel, Rajm. Flora. in Pal. Indica.

SPHENOPTERIS POLYMORPHA, n. sp., Pls. XVI, Figs. 5—7 & XVII.

Fronde tripinnata; rhachide primaria et secundaria late aluta; pinnis alternantibus, sub angulo subrecto e rhachide primaria eggredientibus; tota in fronde differentibus; superioribus semel pinnatis, pinnulis solum paulo sinuatis aut lobatis, alternantibus‡; mediis longioribus, etiam semel pinnatis, aut pinnulis distincte lobato-incisis; imis longissimis distincte bipinnatis,§ pinnulis pinnatis, longioribus; pinnulis earum pinnularum denticulatis; nervis pinnularum primariis e rhachide pinnarum eggredientibus, nervos secundarios in lobos aut pinnulas (secundi ordinis) emittentibus, furcatis.

There are several specimens, which gave me the idea of this form.

One specimen especially, portions of which are figured on pl. xvi, figs. 5—7 shows the characters of this form plainly.

* From coal-measures in Bohemia.

† Mr. Oldham, Mem. Geol. Surv. Ind. II., p. 32, mentions, it is true, the genus *Sphenopteris*, but no species is named and no discussion nor any precise locality is given.

‡ So they are throughout.

§ Tota frons hoc modo tripinnata.

The upper portion of the frond (pl. xvi, fig. 5.) is only bipinnate, the pinnæ have pinnulæ which are only a little lobed; in the middle portion the pinnulæ are longer and more deeply lobed, and we can call them pinnatifid; the lowest are the longest, and again distinctly pinnate, and these second pinnulæ are again a little denticulated. The veins of the pinnulæ pass out from the rhachis of the pinnæ and send up the branches to the lobes or into the secondary pinnulæ and there they are forked. The pinnulæ have a peculiar arrangement on the pinna: only the lower ones begin with a pinnula in the angle of the chief rhachis and that of the pinnæ, while of the upper ones the first is pretty distant from the chief rhachis.

Both the chief rhachis and the rhachis of the pinnæ are broadly winged.

These three different states of the frond I observed in one case on one specimen, while in others I found them separated on different slabs. But with the assistance of that one specimen, all can be referred to the same species; from this different state of the pinnæ and pinnulæ in the several portions of the frond I have called the species "*polymorpha.*"

Of the other specimens I have figured some portions on plate xvii which plainly show the various sizes and shapes of the pinnulæ.

This fern has some analogies.

First I must mention McClelland's *Pecopt. affinis*, (Report Geol. Surv. Pl. XIII, Fig. 11 b.) As far as one can judge from the bad figure, there pass out from the rhachis of the pinna a pretty strong midrib into the pinnulæ (of the first order), and from this midrib a secondary vein passes into each distinct lobe of the pinnula (indicating pinnulæ of the second order), and here the secondary veins are forked. This agrees quite well with the character of the nervation in our *Sphenopteris polymorpha*, especially in the larger specimens, and I have no doubt but that this *Pecopteris affinis* of McClell. with great probability belongs to the same fern. The inspection of the original specimen, which will be later figured again, confirms my view.

Amongst other fossil ferns, our species can be compared in some way first with that form which was originally described as *Pecopteris alata*, Bgt.,* from the Hawkesberry beds in Australia, but which later was ranged with *Sphenopteris*, and recently by Schimper with *Sphenopteris Hymenophyllides*, Schimp. Our species has in common with this the broadly winged rhachis and, besides this, the shape of the upper pinnæ, but the lower pinnæ cannot be compared with ours, the secondary pinnulæ being not so denticulated. Both these species may in the younger states be pretty similar, while differing in the older ones.

The lower pinnulæ of our fern resemble rather those of the *Pecopteris athyrioides*, Bgt.,† now *Sphenopteris athyrioides*, Bgt. sp., from the Yorkshire

* Hist. d. végét foss. p. 361, pl. 127.

† l. c. pl. 125, f. 3.

Oolite, only that this latter species has no winged rhachis. Thus, our fern presents some points of resemblance to mezozoic forms only, although it cannot be identified with any one of them.

The same species occurs also in the Barakur group at Talchir (Cuttack) in Orissa.

Order PECOPTERIDES (eæ.)

An order which is the most frequent in the whole fossil flora, but everywhere are represented certain types and forms which are characteristic of certain strata, although the relations of all to one another cannot be denied.

In the existing flora we find analogues of the fossil *Pecopterides* amongst the *Aspleniaceae, Aspidiaceae, Acrostichaceae*, and true *Pterides;* therefore in general amongst the *Polypodiaceae*, tribe *Polypodeae*. Only in cases where the fructification is preserved, can one determine the family more exactly; in other cases we can judge only from the venation and therefore only generally. By this proceeding of course it may sometimes happen that forms of the same living genus are taken in the fossil flora as different as long as the fructification is unknown; I may mention for instance the carboniferous *Alethopteris Serli*, Bgt., which is certainly a *Pteris*, and, again, *Lonchopteris rugosa*, Bgt., which in form closely resembles *Alethopteris Serli*, only that it has a net-venation; but we know that in the living genus *Pteris* the same relations obtain: for instance, *Pteris Schiedeana*, Presl., *Pt. comans*, Forst. *Pteris polyphylla*, Presl. have a net-venation, while *Pt. pseudolonchitis* Bory, *Pt. nemoralis*, Willd., and even the common *Pt. aquilina* and a great many others, have free and forked veins with a similar shape of the leaflets.

Mr. Ettingshausen in the above-mentioned work has attempted to distribute the fossil *Pecopterides* (as *Alethopteris, Pecopteris*, etc.) amongst the different living genera, as he fancied himself able to do from the venation.

The chief living genera in which Mr. Ettingshausen saw analogies to the fossil *Pecopterides* are shortly the following :—

PTERIS, Linn.

Pteris Serli, Pecopteris Serli, Bgt. *(Alethopteris)*.
Pt. lonchitica, Pecopt. lonchitica, Bgt. (*Alethopteris)*.
Pt. Whitbyensis, Pecopt. Whitbyensis, L. H. etc. (*Alethopteris*).

ASPLENIUM, Linn.

Asplen. Radnizense, Pecopt. Radnizensis, Stbg. sp. *(Cyatheites)*.
Aspl. simile, Pecopt. similis, Stbg., etc.

PHEGOPTERIS.

Phegopt. arguta, Pecopt. arguta, Bgt. *(Cyatheites)*.

ASPIDIUM.

Asp. lanceolatum, Pecopt. lanceolata, Stbg.

HEMITELIA.

Here are to be ranged most of the fossil *Cyatheides*, etc.

Mr. Schimper, in his 'Pal. végét.', endeavoured to establish a reasonable method, which, however, cannot always be used.

He kept the generic name *Pecopteris* and joined with it the name of the living genus to which he thought the fossil belonged to indicate a subgroup: thus, he has *Pecopteris Cyatheides, Pecopteris Aspidides*, etc.; but besides this, the peculiar genus *Alethopteris*, Göpp., which differs considerably from *Pecopteris*. But I think it is better to distinguish not only *Alethopteris*, Göpp., but the fossil genus *Cyatheites* also, and to range with *Pecopteris* only those forms which cannot be united with either of these two.

Genus **Alethopteris**, Sternberg, 1838.

Fronde bi- vel tripinnata. Pinnulis plerumque integerrimis nonnunquam denticulatis tota basi adfixis, saepius basi dilatatis ac connatis, rarius subconstrictis, sed etiam connatis; margine nonnunquam reflexo (soros obtegente?), nervo medio plus minusve distincto, ex rhachide eggrediente usque ad apicem continuante, nervis secundariis sub angulo subacuto eggredientibus, simplicibus, vel semel (superioribus) vel bis (inferioribus) furcatis, parallelis aut divergentibus*†, *ad marginem productis. (Fructificatio familiae).*

Alethopteris is represented in the existing flora especially by forms of the genus *Pteris, Phegopteris*, etc. Of *Pteris* I will mention the common *Pteris aquilina, Pteris arachnoidea*, Kaulf., *Pteris Smiethiana*, Prsl., *Pt. flabellata*, Thunb., etc.; of *Phegopteris, Phegopteris decussata*, Mett.

From the mezozoic epoch we find described a good number of species, which, however, when compared together show great likenesses as well in the shape of the leaflets as in the venation. This has been lately recognised and acknowledged by several authors.

Alethopteris Whitbyensis, Göpp., is the typical form to which a good many of the mezozoic forms can be referred, some of them being even identical with it, others very closely related.

Mr. Schimper (Pal. végét. I. 569) indicated this by speaking of a group of *Alethopt. Whitbyensis*, Gopp.,‡ to which many species were referred.

* In this case the form agrees with *Pteris*.

† In my Flora of Kach (Pal. Ind. XI, No. 1, 187, p. 22), when giving the diagnosis of *Alethopteris*, I said only "*divergentibus*," whereas I should have said "*parallelis aut divergentibus.*"

‡ When speaking of *Alethopt. Australis*, Morr., Schimper says: "*Cette fougère appartient au groupe de l'Alethopt. Whitbyensis*, Göpp., *groupe qui parait être propre au terrain jurassique.*"

In my Flora of Kach (Pal. Ind. XI, pt. 1, p. 22), I also speak of a group of *Alethopteris Whitbyensis*, Göpp. (Lindl. and Hutt.), and on p. 27 enumerate all the species which I think can be brought into any connection with it.

Of our Indian fossils are to be placed here *Alethopt. Whitbyensis*, Göpp. (*Alethopteris tenuis*, Bgt. sp.), *Alethopteris indica*, O. M., *Alethopteris Lindleyana*, Royl. sp. M. Saporta* has re-established for all these mezozoic forms the genus *Cladophlebis*, with which they are to be ranged, and this author has a *Cladophlebis Whitbyensis*, *Cladoph. Rösserti*, etc., both of which latter he considers as scarcely distinguishable; so that I was right when I placed the *Alethopt. indica*, O. M., the near relationship of which to *Alethopt. Rösserti*, Schenk, cannot be denied, in the group of *Alethopt. Whitbyensis*.

Group of *Alethopteris Whitbyensis*† (Schimper 1869, Feistmantel 1876.)
Of Mr. Wood-Mason's specimens one belongs here.

ALETHOPTERIS LINDLEYANA, Royle sp., Pl. XX, Fig. 7.

1869. *Pecopteris Lindleyana*, Royle, Illustr. Bot. etc. Him. Mount. Tab. 2, f. 4.
1849—50. ——— ——— McClelland, Rep. Geol. S. India, Pl. XIII. f. 10. a. b. c.
1845. ——— ——— Unger, Synopsis Plant. foss. 96.
1850. ——— ——— Unger, Genera et Species Plant. foss. p. 171.
1861. ——— ——— Schimper, Pal. végét. I. p. 568.
1876. ——— ——— Feistmantel, Rec. G. S. Ind. IX. 3. p. 76.

Fronde bi-pinnata; pinnis patentibus, rhachide eorum crassiore; pinnulis tota basi sessilibus, attingentibus, oblonge-ovalibus, margine integris aut sinuatis; nervo medio usque ad apicem excurrente nervis secundariis angulo subacuto eggredientibus dichotomis; sporangiis ramis insidentibus. (Feistmantel *ex parte*).

Royle was the first to figure this species; but he has given no description; his specimen, too, could not have been a well-preserved one, but it gives at any rate the form of the leaflets.

In McClelland's Report (l. c.) we find added three figures more, which, however, are very badly drawn, as also is his *Pecopteris affinis* (l. c. Pl. XIII. Fig. 11. a. b.), of which fig. 11 must certainly be placed with *Alethopteris Lindleyana*, Royl., while fig. 11 *a.* is a bad representation of the same fern of which I give figures on pls. xvi. and xvii, and which, as I think, belongs to another type of plants, and I have described it amongst the *Sphenopterides*. The worst thing in McClelland's figures is the veins in the leaflets, which are quite unnatural. So it is also with his figures of *Alethopt. (Pecopt.) Lindleyana*, Royl.

* Pal. Francaise, Vegét. fossiles, Jurassiques et Triasiques, p. 298 et seq.

† *Cladophlebis*, Saporta, Pal. Franc. Veg. foss. Jur. 298.

We can, however, still recognize that we have to deal with an *Alethopteris,* Göpp., as some of the originals are still in the Museum of the Geological Survey.

Mr. Oldham* from the first compared this *Alethopteris Lindleyana,* Royle, with *Pecopteris Australis,* McCoy. I think there is an analogy in so far as they both belong to the same mezozoic group.

Schimper has recently† described this species as *Alethopteris Lindleyana,* Royl., between *Aleth. indica,* O. M. and *Alethopt. australis,* Morr., and says of it (p. 569), "*Cette espèce paraît également appartenir au group de l'Alethopteris Whitbyensis,* etc."

The figures of Royle and McClelland were all taken from sterile fronds. Amongst Mr. Wood-Mason's specimens is a fructificating pinna, which in the form of the leaflet agrees perfectly with that of *Pecopt. Lindleyana,* Royle (l. c.), so that I do not doubt but that I have this species before me, and I must consider it as a fertile frond of *Pecopteris Lindleyana,* R.

It is only a fragment of a pinna with 4 pinnulæ on each side. The form of the leaflets besides agreeing with Royle's figure (l. c.) shows also a similarity to certain forms from the Rajmahal Hills which I consider to belong to the *Alethopteris indica,* O. M., and of which one specimen will be figured on Pl. XXXVI of the continuation of the Rajmahal Flora, now in the press and shortly to be issued.

The specimen under discussion is the second instance of a fern found in fructification in the Raniganj field‡; fructificating ferns are as yet very rare, and we know besides these two specimens only *Glossopteris indica,* Schimp., from Kamtí (Nagpúr district) with fructifications preserved.

The rhachis of the pinna is pretty thick, the pinnulæ broadly ovate, connected at the base, with a slightly waved margin.

The chief veins fine, as also are the secondary ones, which seem forked; the sporanges inserted on the secondary veins, on the surface of the pinnula, about midway between the midrib and the margin.

There are generally from six to eight sori in each row.

From the manner of fructification and from the shape of the leaflets, we could perhaps trace an analogy between our species and some forms of the genus *Polypodium,* perhaps *Polypodium spectabile,* Sprengel (Kaulf.), *Polypodium concinnum,* Presl. (and others), *Polypodium submarginale,* Sprengel, *Polypodium amplum,* Presl., and other species. (Some of these are also described as *Phegopteris.*)

* Mem. G. S. Ind. Vol. II. p. 328.

† Pal. veget. I. pp. 568, 569.

‡ A fructificating pinnula, as I suppose, also of *Alethopteris (Pecopt.) Lindleyana* is amongst McClelland's originals, but was never mentioned.

Amongst fossils the non-fructificating frond can be compared, as I have said, with some fronds of our *Alethopteris indica*, O. M., from the Rajmahal Hills.

Alethopteris comp. Whitbyensis, Göpp., Pl. XXI, Figs. 6, 6*a*.

Two pinnulæ of a fern which I can only place with this species, as they are so near that I do not think it advisable to separate them.

Our pinnulæ are more closly allied to Brongniart's *Pecopteris tenuis*,* from the Yorkshire Oolites; but in my Kach Flora† I have shown all the species which are synonymous with or related to this *Alethopt. Whitbyensis*, Göpp., and amongst them *Pecopt. tenuis*, Bgt., is the first. There is nothing peculiar in the occurrence of this species in our Raniganj Series, since we know that the fossils of this group are more closely related to one another than was formerly thought, and since Saporta‡ has shown that this *Cladophlebis Whitbyensis*, Göpp., and *Cladophlebis Rösserti*, Schimp., (a Rhætic form) are almost identical. To the *Pecopt. Rösserti* (*Cladophlebis*) our *Alethopt. indica*, O. M., from the Rajmahals is very closely allied, and to this latter again the *Alethopt. Lindleyana*, Royle sp., of the Raniganj Series; and now we have the *Pecopt. tenuis*, Bgt., identical with the *Alethopt. Whitbyensis*, Göpp.

Type *Phegopteris*, Mett.

There is a very big specimen of a fern which from a palæontological point of view is an *Alethopteris*. But a closer examination shows that the specimen has a very close relation in the existing flora, and it is amongst the *Aspidiaceae* with single secondary veins.

There is the genus *Phegopteris*, which is in some forms almost identical with our fossil, our *Alethopteris* agreeing especially with *Phegopteris decussata*, Mett. I could at once establish on this specimen this living genus in the fossil flora, but in conformity with the palæontological classification, I retain the generic name *Alethopteris*, using *Phegopteris* to form the specific name, and placing this new species in the type *Phegopteris*. This fossil is, therefore, especially of interest as so closely resembling a living genus; but there are some differences, as we shall see in discussing the species.

Alethopteris Phegopteroides, n. sp., Pl. XVIII.

Fronde valida, bipinnata; rhachide crassa, punctulata; pinnis sub angulo subrecto e rhachide eggredientibus, rhachide earum crassiore; pinnis mediis longissimis basin apicemque versus attenuantibus; pinnulis oblon-

* Hist. d. végét. foss. Pl. 110. f. 3. 4.

† Kach flora in Pal. Indica, Ser. XI. 1. 1876. pp. 22—25.

‡ Végét. foss. Terr. Jur. de France, p. 298 *et seqq.*

gis incurvatis maxime approximatis, omnibus aequalibus oblique insertis, primis solum verticaliter adfixis et paulo latioribus, omnibus ad bases connatis; nervo primario pinnularum distincto ad apicem promoto; nervis secundariis singulis sub angulo acuto eggredientibus. Fructificatione non obvia.

A big slab of shale contains two fronds, besides smaller fragments, of this interesting fern.

The chief characters which are to be observed are in the pinnulæ; these are oblong, closely set, a little incurved and oblique to the rhachis of the pinna, only the first pinnulae near the chief rhachis being vertically inserted, and a little broader than the others, so that they are distant from them; the midrib is pretty thick and reaches to the apex; the secondary veins are single, passing out at an acute angle from the midrib; the lowest two in that portion of the pinnula which is directed from the chief rhachis are arcuate, the rest being quite straight.

The pinnæ are longest in the middle of the frond and are shorter at base and towards the apex. The chief rhachis pretty thick.

I have figured two portions of the specimen; one of them shows two pinnæ, which are entire, with the end leaflets. Two other figures illustrate the disposition of the veins and the bases of the pinnulæ and the top portion.

From this we see plainly the relation with the *Aspidiaceae* and especially with *Phegopteris*, of which *Phegopteris decussata* is the nearest.

One sees well in our specimen the triangular empty spaces between adjoining pinnulæ, where these are connected: these contain no veins.

This type of fossil is quite peculiar, and I do not know any form in the palæozoic strata at all analogous to it.

But on the other hand there is in the Trias a form which was first described as *Pecopt. Stuttgardensis*, Bgt.,* but later by Schimper† was placed in a new genus *Lepidopteris* (in the *Pecopterides*).

On Brongniart's figure, which, however, is not quite distinct, one sees very distinctly the single veins arranged in a similar way to our specimen, but I think the shape of the leaflets is different, as they are a little longer and not so incurved, and they are also more deeply separated, but I do not know if the punctation of the rhachis can be considered as a sufficient character, as all ferns present it more or less.

Into this genus *Lepidopteris*, Schimper placed also the rhætic form, *Asplenites Ottonis*, Schenk, as *Lepidopt. Ottonis*, Schimp., of which we find near relations amongst the Rajmahal fossil plants.

I think the *Pecopteris arguta*, Bgt.,‡ from the coal-measures, belongs

* Histoire d. végét. fossiles, 1820, Pl. 130, f. 1.

† Pal. végét. I. p. 572, Pl. XXXIV. f. 1.

‡ Brongniart, Hist. d. végét. foss. Pl. 108, f. 3. 4.

to the same type of fossils, but our species is much more nearly allied to the living *Phegopteris* than to any fossil species,

Order TÆNIOPTERIDES.

In my preliminary 'Note on the Flora of the Damuda Series'* I have already pointed out that the Damúdas are by no means without a *Taeniopteris*, but that, on the contrary, forms of this order had been known for several years from these rocks; they occur especially in the Kamthi and Raniganj groups (both of which, however, are of the same horizon), and also in the Barakur group.

The majority of the *Taeniopterides* belong, as we know, to post-palæozoic epochs, the mezozoic epoch being especially rich in species of this order. There are, it is true, some forms in the Permian formation, but these are very rare and scarcely of any importance, while in the mezozoic they are frequent.

In the occurrence of this genus in the Damúdas, I see a connecting link between the lower and upper Gondwanas, as in these latter (Rajmahal Series) analogous forms are very frequent.

Brongniart† knew only the one genus *Taeniopteris*, but since his day other discoveries have been made, so that Schimper in his 'Palæont. végét.' could give a pretty complete division of this order.

In my Kach flora‡ I have given a close discussion of this order and need therefore only shortly indicate here Schimper's division; he distinguishes:—

1. *Taeniopteris*, which he restricts to the few palæozoic forms.
2. *Macrotaeniopteris*, Schimp. especially mezozoic forms; of Indian specimens belong here the greatest part of the broad-leaved forms from the Rajmahal Hills and besides these some forms from the Kamthi, Raniganj, and Barakur groups.
3. *Angiopteridium*, Schimp., a mezozoic type, to which especially some of the Rajmahal species belong and perhaps one from the Kamthis.
4. *Oleandridium*, Schimp., begins in the mezozoic epoch. We have one species from Kach.
5. *Danaeopsis*, a Triassic form, but here found, as I think, in the Liassic Rajmahal group.

Marattiopsis, Sch., and *Danaeides*, Schimp., are of no interest for us. From this division the living affinities are plainly seen, and they particularly are—

Aspidium Nidus for *Macrotaeniopteris*.
Angiopteris for *Angiopteridium*.

* Rec. Geol. Surv. IX. 3. p. 74.
† Prodrome and Histoire, 1828.
‡ Pal. indica, XI. 1. 1876.

Oleandra for *Oleandridium.*

Danaea for *Danaeopsis*, Heer.

From our Raniganj Series we have to deal only with *Macrotaeniopteris.*

Genus **Macrotæniopteris,** Schimper, 1869.

Schimper, Palaeontol. végét. I. p. 610.

Frondibus simplicibus, speciosissimis, plus minus elongato, obovatis, obtusis vel acuminatis nonnunquam etiam apice emarginatis, integris, raro irregulariter pinnatifissis, interdumque denticulatis. (*Fructificatione Aspidiacearum*, Schimp.)

With this genus Mr. Schimper placed all the broad-leaved mezozoic forms which are allied to *Neottopteris Nidus.*

Our broad-leaved *Taeniopterides* from the Rajmahal Hills belong to this genus.

To the palæozoic forms Schimper would restrict the generic name *Taeniopteris*, Bgt., in which he is, as I think, quite right, although there is one species in particular, *Taeniopteris abnormis*,* from the Permian in Saxony, which has nearly all the characters of *Macrotaeniopteris*, Schimp., the only difference to be detected being in the very close-set veins.

In a paper on the *Taeniopterides* from Chemnitz in Saxony,† Dr. Sterzel has redescribed the *Taeniopteris abnormis*, Gutb., and has found that this species is very closely allied to several mezozoic forms, amongst which are the *Macrot. gigantea*, Schenk., and our two Rajmahal species *Macrot. lata*, Oldh. Morr., and *Macrot. Morrisi*, Oldh.‡ Dr. Sterzel considers, therefore, this Permian species also as a *Macrotaeniopteris* and as a precursive form of several of the mezozoic species.

The relations of our Rajmahal species with the Rhætic *Macrot. gigantea*, Schenk., I have already pointed out in my first note on the fossil plants from the Rájmahal group (Rájmahal Hills).§

Macrotæniopteris Danæoides, Royle sp. (McClell.)
Pl. XIX, Figs. 1, 2 & XXI, Fig. 1.

1839. *Glossopteris danaeoides*, Royle, Illust. Bot. etc. Him. M. Tab 2.

1849-50.———— ———— McClelland, Rep. Geol. Surv. India, XV. f. 1.

1876. ———— ———— Feistmantel, Notes on the several floras in India, Rec. Geol. Surv. Ind. IX. 3. p. 74. Ibid., IX. 4.

Fronde speciosa, oblongo-ovata, apice obtuse acuminata, basi attenuata obovata, distincte pedicellata, ad 34 *cm. longa et* 10 *cm. lata, subcoriacea;*

* Gutbier, Versteinerungen des Rothliegenden in Sachsen, 1849, Pl. VII. f. 1. 2.

† Ueber die Tæniopteriden von Chemintz in Sachsen N. J. f. M. Geogn. 1876.

‡ This however only partly.

§ Rec. G. S. Ind. IX. 2. p. 36.

rhachide mediocri striata; nervis secundariis sub angulo suberecto e rhachide eggredientibus, usque ad 1·5 *mm. distantibus, marginem versus paulo incurvatis, crassiusculis; simplicibus et furcatis alternantibus, furcatione differentibus in partibus longitudinis nervorum exhibita.*

The species was first described by Royle (l. c.) as *Glossopteris danaeoides*, although there is not anywhere the slightest anastomosis of the veins, which on the contrary are all parallel and dichotomously forked.

This fern belongs undoubtedly to the same species which McClelland later described as *Taeniopteris danaeoides* also from the Raniganj (Burdwan) coal-field; but his figures (Pl. XV 1, 1*a*, 16) are very incorrect, especially the enlarged portion (Fig. 1*b*). But we can at any rate certainly conclude from them that this *Taeniopteris* was found a second time in the Raniganj field, as McClelland's specimens do not differ from those of Royle. Later the same species has been brought by Mr. Hughes from the Jherria coalfield, where, as Mr. Hughes assures me, it is pretty frequent, though I can find only one specimen in our collections;—and now Mr. Wood-Mason has brought pretty numerous specimens of it from Raniganj, and his statement is that he brought only the very best, while he left behind great numbers of fragmentary ones. Also in the Barakur group in the Rajmahal Hills (near Burgo) the same species has occurred.

Taeniopteris is, therefore, as is seen from this examination, not wanting in the Raniganj field and from the Damudas generally, the more so if we consider that from the Kamthis also several specimens are known.

I have figured two specimens and two enlarged portions; the two figures complete one another, one being the basal, the other the apical portion.

The chief character of this species is the very distant veins; these pass out from the rhachis, which is proportionally thin, at nearly right angles, and run almost straight to the margin, where they are a little incurved; the veins are about 1·5 mm. apart; simple and forked veins alternate; the furcation does not follow any constant law; some of the veins are forked at the very base and may be forked again, others more towards the middle, and others quite close to the margin.

The apex is obtusely acuminate; at base the frond is obovate and apparently pedicellate.

The biggest frond is 10 cm. broad and must have been at least 34 cm. long.

By the great distance of the veins apart this species differs from all others, but most approaches that from the Rajmahal hills which Messrs. Oldham and Morris described as *Taeniopteris musaefolia*,* but which is, as I think, barely distinguishable from *Taenopt. lata*, O. M.; the only differences detected by Mr. Oldham being the slightly more distant veins and the more coriaceous consistence of the frond.

* Rajmahal Flora, Pal. Ind. 1862, Pl. IV. f. 1.

But these Rajmahal species approach on one hand pretty nearly the Rhætic *Macrot. gigantea*, Schenk,* on the other hand those forms from the Kamthis which I have lately briefly described as *Macrot. Feddeni* Fstm.,† and which are all to a certain degree related to that Permian *Taeniopt. abnormis*, Gubb., of which I have already spoken.

These species are all based chiefly upon the different distances apart, the formation, the direction, and the thickness, of the veins, and if we compare all together, then we have the following table:—

1. *Macrotæniopteris danaeoides*, McClell., with the most distant veins, nearly straight.
2. *Macrotaeniopteris gigantea*, Schenk., and the Rajmahal species, *Macrot. lata*, O. M. and *Macrot. musaefolia*, O. M., with veins almost equally distant.
3. *Macrot. Feddeni*, Fstm., with pretty close veins, a little oblique.
4. *Taeniopt. (Macrotaeniopt) abnormis*, Gatb., with very close and almost straight veins.

For us it is a great satisfaction to find the genus *Macrotaeniopteris* so frequently represented, as Mr. Oldham to the last maintained that no *Taeniopteris* are in the Damudas,‡ and in a letter to Mr. W. B. Clarke, which this latter gentleman has published in his 'Remarks on the Sedimentary formations in New South Wales,' 3rd Edition, 1875, p. 29,§ Mr. Oldham maintains that in the Panchet group also no *Taeniopteris* has been found, although it occurs.

Amongst all the numerous specimens not one occurred which showed any trace of fructification, so that it cannot be decided with certainty to which living genus the species should be referred, but as far as can be judged from the form of the leaf and from the veins I would refer it to some form of *Acrostichum*, for example, *Acrostichum hybridum*, Bory. Its fossil allies have been already indicated.

Macrotæniopteris sp.

Another specimen of *Macrotaeniopteris* occurred; but it unfortunately is so badly preserved that it cannot be figured nor any exact description of it given. It is only a portion of a leaf-surface, no rhachis being preserved.

* Schenk, Flora des Grenzschichten, Tab. XXVIII. p.146.

† Records G. S. Ind. IX. 4.

‡ In Mem. G. S. Ind. II. p. 329 he said so quite plainly.

§ In the Mines and Mineral Statistics of New South Wales, 1875, where Mr. W. B. Clarke's Sedimentary formations, etc., is included, page 175.

It shows that the leaf was much bigger than those of the species just described, and that the veins are much closer together and are not so straight and stiff as in *Macrotaeniopteris Feddeni*, Fstm. from the Kamthis, so that I would not venture to identify it with this species.

I mention this specimen only to show that another kind of *Macrotaeniopteris* also occurs at Raniganj besides *Macrot. danaeoides*, and I am sure that further investigations will furnish more fossils of this kind. These *Macrotaeniopterides* establish a palæontological relation between the lower and upper portions of the Gondwana system.

Type *Vittaria*, Swartz.

Genus **Palæovittaria,** nov.

On pl. xix, fig. 3 is figured a splendid specimen, which from the characters of the veins must be considered a fern. There is a distinct midrib (*rhachis*, *costa*) in the lower part of the frond, pretty broad, becoming thinner upwards and vanishing completely in the apical portion.

The secondary veins pass at very acute angles towards the margin, where they are a little incurved; they are single and forked as in *Taeniopteris*, but the specimen cannot be placed with this genus, and recalls, as Dr. Kurz informs me, in this character the nervation of the living genus *Vittaria* only, so that I use for our fossil the generic name *Palaeovittaria.*

Diagnosis.—*Frondibus simplicibus, oblongato-ovalibus, costa apicem versus evanescente. Nervis secundariis sub angulo acutissimo eggredientibus. Nervatio* Vittariæ.

There is only one species, which I call

Palæovittaria Kurzi, n. sp., Pl. XIX, Figs. 3—4.

Frondibus aggregatis, simplicibus, oblongato-ovato-spathulatis, margine integris, nonnunquam apice excisis, nervo medio (costa) inferiore in parte crassiore, dimidiam partem versus evanescente; nervis secundariis sub angulo acutissimo e rhachide exeuntibus, in parte apicali radiantibus, simplicibus et furcatis; marginem versus incurvatis, sequente precedentem ea in parte attingente. Fructificatione non obvia.

About 9 fronds come out from a common point; they are generally oblong-spathulate, entire on the margins, but they are sometimes deeply emarginated and therefore bilobate at the apex.

The chief characters are in the midrib and in the secondary veins; the former is well developed and distinct in the lower portion of the leaf, but in the upper portion this vein vanishes, becoming dissolved in the secondary veins.

The secondary veins pass out from the rhachis at a very acute angle pretty straight towards the margin, where they are incurved. In the apical portion, where is no midrib, the secondary veins radiate fan-wise. The secondary veins are alternately single and forked; the furcation occurs at different parts of the length of the veins, all of which are regularly equally distant from one another. I cannot observe any distinct peduncle; the leaf becomes more attenuate towards the base and the rhachis thicker, until at last only the latter remains.

It seems certain that the aggregation of the leaves is not due to an insertion on a common stalk, but rather to associated growth out from the rhizome. As I have said, this form has no analogue in any existing fern except *Vittaria*, where also the rhachis vanishes towards the apex and the secondary veins pass out at a very acute angle from it; the only difference being that our fern has many more secondary veins, and that the frond in proportion to its length is much broader. I have obtained from Mr. Kurz a good collection of Indian *Vittariae* for comparison, and of these the *Vittaria intermedia* from Java comes nearest to ours. But amongst the American forms are some still broader ones, which would come still nearer.

Amongst fossils nothing is as yet known at all like our fossil plant.

If we take the single leaf and consider only its shape and the general disposition of the veins, then we find an approximate similarity in *Sagenopteris*, but here the leaves come out from a common stalk and the secondary veins anastomose so as to form a net-venation.

Amongst the *Taeniopterides* we find scarcely any similarity, as all these have a rhachis continuous to the apex of the frond, and the angle at which the secondary veins pass out from it, as for instance in *Taeniopteris Morrisi*, Oldh.,* or in *Phyllopteris plumula*, Sap.,† far less acute than in our fossil.

IV.—DICTYOPTERIDES.

This order includes all ferns with net-venation. This is again only a palæontological order, for in the same living genera are forms with forked, as well as with netted veins, for instance, in *Pteris*, *Asplenium*, etc.

But there is yet a peculiarity: it is that most of the ferns with net-venation occur in the mezozoic epoch, without any corresponding forms with free veins, while in the palæozoic epoch the ferns with net-venation are very rare, those with free veins predominating. In the palæozoic we have mostly only *Lonchopteris*, Bgt., which has its analogy in *Alethopteris*, and *Dictyopteris* with complete analogy in *Neuropteris;* so that the order *Dictyopterides* (*eae*) can very fairly be considered to be a mezozoic one.

* Oldham and Morris, Rajmahal Flora, Pal. Indica, 1862, Pl. III, f. 1.

† Saporta, Végét. foss. de France (Palæont. Française), Pl. LXIII, f. 6.

There are a good many genera which to a great extent have living analogies, and those sometimes very close.

In Schimper's 'Palæontologie végétale,' p. 737, we find the whole sequence of genera which at that time were known; 15 genera being enumerated.

Of these two occur in our Raniganj Series.

But to Schimper's list must be added, *Gangamopteris*, McCoy, first described as *Cyclopteris*, but having also a net-venation.

To this genus belongs also that fossil from the Talchir which until recently was generally quoted as *Cyclopteris*, but which lately I described as *Gangamopteris cyclopteroides;* of this genus I will describe another species in this present paper.

Genus **Belemnopteris**, nov.

Fronde simplici late sagittaefoliosa pedunculata. Nervis primariis tribus, medio crassiore, ceteris anastomosantibus.

Amongst Mr. Wood-Mason's specimens are two, of which one is tolerably complete and has an arrow-like shape, with 3 chief veins, one stronger passing into the leaf, two others a little thinner into the two basal lobes; the other venation is netted.

It strongly reminds one of some living ferns.

1. First we have *Gymnogramme sagittata*,* a *Polypodiaceae* which formerly was described as *Hemionitis sagittata*, Féé., with which the *Hemionitis cordata*, Hook. and Grev. (*Hemionitis cordifolia*, Roxb.),† is identical; of this later Mr. Kurz has lent me specimens from Dacca.

With this fern our fossil has little more than the shape of the leaf and perhaps also the primary veins in common, while in the net-venation the two are rather different.

2. There is another fern with which our fossil can be compared, especially as regards the net-venation: this is *Pteris sagittaefolia*, Raddi‡; this fern is narrower than ours, but the disposition of the 3 primary veins, and the net-venation particularly, agree well with the same in our fern.

Of course, only the fructification can decide to which of these two our fossils should be placed, but as none is to be seen and as our fern cannot be identified with either, on the contrary, presents characters of both, I consider myself justified in establishing a new genus.

It is of very great interest (1st) as it is a form so closely allied to living ones, and (2nd) as it is a fern with a net-venation.

* See Ettingshausen, Farrenkräuterder Jetztwelt, etc., 1865, p. 59, Pl. XXXI, f. 9.

† See Beddome, Indian ferns (of South India), Pl. LII. p. 18; also Lowe, Ferns, etc., Vol. VII, Pl. XXXVIII, p. 93.

‡ Ettingshausen, l. c., p. 104, Pl. LXXI. f. 3.

Belemnopteris Wood-Masoniana, n. sp., Pl. XX, Figs. 1—2.

Fronde simplici, late sagittaefolia, apice obtusa, margine integerrima, tota ad 10·5 *cm longa, lobis obtuse acuminatis longioribus* (5·3 *cm longis) ; nervis primariis tribus ; uno crassiore in folii superficiem excurrente, duobus aliis tenuioribus, in lobos currentibus, omnibus tribus apicem versus attenuantibus ; nervis secundariis sub angulo subacuto eggredientibus, anastomosantibus, retia plerumque hexagonalia, sed etiam polygonalia, formantibus. Fructificatione ignota.*

Of the relations of this fern I have already spoken when discussing the genus; they are only in the living flora, nothing like it being known amongst fossils.

The frond is simple, is shaped like a broad arrow, at the apex obtuse; the margin entire, slightly arcuate, the total length 10·5 cm; the basal lobes obtusely acuminate, pretty long (5·3 cm.). The chief characters lie in the veins: there are three chief veins, one passing into the surface of the leaf, the two others, a little thinner, into the two basal lobes.

The secondary veins pass out at a subacute angle so as to form a net-venation with hexagonal or polygonal meshes.

This is one of the finest specimens in Mr. Wood-Mason's collection.

Genus **Gangamopteris**, McCoy, 1875.

I have already had occasion to mention this genus in my first note on the Damuda fossils,* when speaking of *Gangamopteris cyclopteroides* from the Barákars being identical with the species in the Talchirs.

In another paper† I have described another *Gangamopteris* from the Kamthis as *Gangamopt. Hughesi*, which is different from, though closely related to, the species from the Barákars and Talchirs, a wider venation constituting the difference.

I now describe a third, differing from both of these by its very wide net-venation.

I think it will not be considered useless and superfluous to repeat that this genus *Gangamopteris* occurs in true mezozoic rocks in Victoria, and that nothing of the kind is as yet certainly known from the lower portion of the New South Wales coal-strata.

Our new *Gangamopteris* is again a form to which some analogies are to be found in the living flora.

Gangamopteris Whittiana, n. sp., Pl. XX, Figs. 3—4.

Fronde simplici, late ovato subrhomboidali inaequilaterali, integerrima, obtuse acuminata ; costa nulla, sulco medio tantum indicata ; nervis ceteris omnibus e basi duobus in directionibus marginem versus radiantibus, omnibus anastomosantibus, retia valida, oblonge hexagonalia aut polygonalia formantibus. Fructificatione non obvia.

* Rec. G. S. Ind. Vol. IX, 3. † Ibid., IX, 4.

I name this fine species (of which two specimens, both of them figured, are in Mr. Wood-Mason's collection) after Mr. Whitty of Kurhurbáli, who last year increased our knowledge of the Kurhurbáli plants by four very interesting species all on the same big slab of shale.

It differs from both those already described by me, as well as from all described by Mr. McCoy from Australia.

Our specimen shows a broadly ovately subrhomboide frond, which besides seems obliquely shaped; the apex is obtusely acuminate; there is no midrib as in this genus generally, this being indicated in the middle only by a slight furrow, from which the secondary veins pass in two directions towards the margin, which is entire; the secondary veins all anastomose and form large oblongly hexagonal or polygonal areoles, larger than in any known species of the genus; the areoles are largest in the middle, becoming smaller towards the margin.

Fructification not observed.

This very fine fern has an apparent analogy to the living genus *Antrophyum*, and to those forms of it which have no midrib; and there are amongst the Indian living *Antrophyum* some species to which our fossil can be compared. I refer especially to *Antrophyum latifolium*, Bl.*, from the Khasya Hills, of which Mr. Kurz has lent me several specimens for comparison. I think this is the only fern to which our fossil can be referred. If this be right, it may well be doubted whether the other two species of *Gangamopteris* should be referred to the same living forms; it is rather possible that this genus also is only a palæontological one, for both the other species of it have the leaves differently shaped, although the disposition of the veins in them is similar.

Genus **Glossopteris**, Bgt., 1828.

Frondibus simplicibus (?), elongato spathulatis, apice obtusis vel acuminatis, "costa usque ad apicem continuante," nervis secundariis anastomosantibus.

This is the famous genus which has caused so much confusion in the determination of the age of our Damúda Series and the Australian coal-strata.

As I have prepared a monograph of it, I will only briefly speak of it here.

a. In Australia *Glossopteris* is known from rocks (the Australian coal-strata) wherein several strata are to be distinguished; the lowest of these is marked by a numerous marine fauna of generally carboniferous alliances. With these some forms of *Glossopteris* occur, though rather rarely.

* Beddome, Ferns from British India, etc., Part XII, Pl. CLXXVI.

b. In the upper coal-strata no marine fauna is found. *Glossopteris* is very frequent, and is associated with other plants with no carboniferous characters at all.

c. Below the lower portion of the coal-strata is a formation with a true lower carboniferous flora and the same marine fauna, of which no trace is in the upper (Newcastle) coal-strata.

d. From this it would follow that the lower coal-strata, with marine fauna of carboniferous age, had been a long time deposited, or that the carboniferous period had passed away, when the upper coal-strata were formed, or when that period began when *Glossopteris* was especially developed, with other plants which contrast with those of the lower portion.

When later the *Glossopteris* was found frequently in the Damúda Series, these were at once compared with the Australian lower coal-measures,* although no trace of any marine organism had ever been found in them, and only a flora occurred which was opposed to such a comparison.

I think our Damúda Series, containing only a flora, cannot be compared with the lower Australian coal-strata at all, which contain hardly anything but a marine fauna.

Such transitional forms as *Glossopteris* in Australia we find here in India also.

So in the Damúda Series and the Panchet group the same *Schizoneura Gondwanensis.*

In the Rajmahal group and in the Jabalpur-Kach group are the same two species of *Ptilophyllum*, Morr., and yet there is a difference in age.

In the Salt Range in India we find in the carboniferous strata on the one hand the Devonian genus *Goniatites*, on the other the mezozoic genera *Phylloceras* and *Ceratites.*

In the Trias of the Salt Range we find again the same *Bellerephon* (a purely carboniferous genus) which in the carboniferous limestone is already frequent, and yet all these strata are different.

So is it in Australia too, *Glossopteris* survives from the lower coal-strata in the upper ones, the former being characterized by a marine fauna.

Here in India it is also of no direct influence on the determination of age, while the other plants with which it is here associated certainly are; it indicates of course only for the whole Damúda Series the same age, as no animal fossils contradict.

But yet another point must be mentioned: most of our species of *Glossopteris* are different from those of Australia, and all the other plants in our Damúdas are much more closely connected with European forms than with any in Australia.

* T. Oldham, Mem. G. S. Ind. II.

I have reported on this subject in my first note on the Damúda fossils,* and have done so recently more at length†; so that here I will be very brief.

1. We must acknowledge the existence of *Glossopteris* in Australia during the time of the lower coal-strata, the character of which is expressed by a most predominant marine fauna.

2. The carboniferous character of the strata ceased with the extinction of the carboniferous fauna, *Glossopteris* still surviving and becoming much more frequent in the succeeding period, which is marked by a flora only indicative of a mezozoic age.

3. In India *Glossopteris* is very frequent too, but mostly under different forms and associated with no fauna, but with a tolerably abundant flora, the alliances of which are unmistakably mezozoic and triassic.

As to the affinities in the living flora, they can be partly found out. In the Kamthis there occur pretty frequently specimens with a fructification consisting of very well-marked sporanges in the areoles, indicating the fructification of the genus *Polypodium;* and this might be the case also with a great many of the others, while a good many of the Raniganj species remind one, in the venation, of the genus *Antrophyum*, and of this those forms with a midrib; we would have, therefore, here also a relation of some of the *Glossopteris*, Bgt., to *Gangamopteris*, McCoy, parallel to that which we find in *Antrophyum*, *i. e.*, forms with and forms without midrib. In the Australian *Glossopterides*, Mr. Carruthers seems to have observed a fructification along the veins; this would perhaps indicate some difference between ours and the Australian ones.

At present I have to mention only two species as contained in Mr. Wood-Mason's collections, one of them in fructification.

GLOSSOPTERIS ANGUSTIFOLIA, Bgt., Pl. XXI, Figs. 2—4.

1828. Brongniart, Hist. des. végét foss. I. p. 227, Pl. LXIII. f. 1.
1845. Unger, Synopsis Plant. fossil, p. 95.
1850. Unger, Genera et Species Plant. foss., 169.
1876. Feistmantel, Rec. G. S. India, IX. 3. p. 72.

Fronde angusta usque ad 18—20 *cm. longa et* 1·7 *cm. lata; apice acuminata, rhachide (costa) crassa, nervis secundariis sub angulo acuto eggredientibus, omnibus anastomosantibus; retibus, rhachidi proximis, maximis, marginalibus oblongis angustissimis. Margine marginato, fructificationem indicante.*

This species was first described by Bronginart (l. c.) from Raniganj; but he had only incomplete specimens, which, however, were given again in Schimper's 'Palæontologie végetale.'

* Rec. G. S. I. IX. 3.
† Ibid, IX. 4.

In Brongniart's figures the veins particularly are not rightly figured, and the margin also is incorrect. This author also made the same mistake in the *Glossopteris Browniana*, drawing the veins as anastomosing only to the middle of the leaf-surface (on both sides of the stalk) and thence to the margin dichotomous only; while they in reality anastomose throughout until they reach the margin. The same is also the case with *Glossopteris angustifolia*, Bgt. In Brongniart's figures we find some nets on each side of the rhachis only, and then the veins are regularly dichotomous. This is not so.

Mr. Wood-Mason has brought several specimens, of which I give three figures, and which show the relations better.

The frond is rather narrow, about 1·7 cm. broad and only about 18—20 cm. long; the rhachis is proportionally very thick (2 mm.) and reaches to the apex; this is quite acuminate; the secondary veins pass out at a pretty acute angle from the rhachis and are there tolerably thick and form tolerably large polygonal oblong areoles; but from here they are resolved suddenly into many branches, which form oblong and narrow areoles up to the margin; here they are curved along the margin in such a manner that one always catches the next so as to form areoles even on the margin, Brongniart representing them as ending straightly.

On both sides of this marginal ending of the areoles one can observe with the lens a smooth line running along the whole margin (see fig. 2a. Pl. XXI), of which in Brongniart's figure nothing is to be seen.

Does this indicate a marginal fructification? If so, then we have perhaps an analogy in *Pteris* or *Schizoloma.*

This dicovery of Mr. Wood-Mason's modifies my statement in Rec. G. S. Ind. IX. 3, p. 72, when I stated, that I had not rediscovered any specimen from India: this was right as to our collection, Mr. Wood-Mason's specimens having been acquired later. The specimen which I mentioned (on the same page) as from the upper portion of the Australian coal-strata, now appears different from our Indian *Glossopt. angustifolia*, Bgt. as above characterised.

Glossopteris communis, Fstm., Pl. XXI, Fig. 5.

Fronde simplici, variante, sed plerumque speciosa, integerrima, ovato-oblonga, apice elongato-acuminata, basi attenuata in rhachidem decurrente, rhachide crassa usque ad apicem currente, nervis omnibus anastomosantibus, retia oblonga, angustissima formantibus. Fructificatione ignota.

Of this species I have given only a portion of a frond, twice enlarged to show the character of the net-venation; in my monograph on *Glossopteris* I shall have occasion to figure a good many nice specimens.

This species, the commonest near Raniganj, is also not wanting in other places. It resembles in shape pretty well the *Glossopteris indica*, Schimper, but the net-venation is different, as also is that of the Australian *Glossopteris Browniana*, Bgt.

I have completed the description a little from other specimens, to make myself understood.

The frond is simple, oblong-oval, the apex oblongly acuminate (as in *Glossopt. indica*, Schimp., while it is obtuse in *Gloss. Browniana*, Bgt.); at base the frond is attenuate, running down into the rhachis; the rhachis thick, reaching to the apex; the secondary veins all of pretty equal thickness, all anastomising; the areoles are all pretty equally oblong and very narrow (while in *Glossopt. indica* they are more polygonal and larger next the rhachis), reaching to the margin. The fructification of this species is unknown to me, but in *Glossopteris indica*, Schimp., it consists, as I have mentioned, of round sporanges in longitudinal rows.

At Raniganj the *Glossopt. indica*, Schimp., seems rarer than *Glossopt. communis*, Fstm., but both species seem to have been of nearly the same size. In the Kamthis *Glossopt. communis* is frequent enough, and it occurs frequently also in the other groups of the Damuda Series.

From Raniganj there are known besides a great many *Glossopterides*, which, however, I will describe later.

Genus **Sagenopteris**? Bgt.

If I am right in placing *Glossopt. acaulis*, McClell.,* in *Sagenopteris*, Bgt.,† then the specimens from Mr. Wood-Mason's collection figured on Pl. XX, Figs. 5, 6, must be placed with it too, as I believe them to belong to the same species which McClelland called *Glossopteris acaulis*. These two specimens do not come out quite plainly from a common stalk, but their relative position to each other on the stone would lead one to suppose that they do so; that they are identical with that species of McClelland seems also to be indubitable, as the net-venation is of the same kind.

What induced McClelland to apply the specific name "*acaulis*" to a plant the leaves of which are so very distinctly pedicellate, I cannot understand, and I think that in this case there will be no objection to my rejecting this specific name, especially as McClelland's figure is so bad, more resembling a dicotyledonous leaf.

It is true that the real *Sagenopteris* from the Rhætic and Lias had not so many, nor such distinctly pedicellated, leaves, but the general disposition of the leaves in our specimens, and their insertion on a common

* Report Geol. Surv. 1848-49, Pl. XIV. f. 3.

† Rec. Geol. Surv. Ind. IX. 3, p. 73.

stalk, the net-venation, and the midrib vanishing towards the apex, seem to justify my placing this form under *Sagenopteris*, Bgt.

Sagenopteris polyphylla, Feistm., Pl. XX, Figs. 5, 6.

Foliis pluribus in pedunculo communi insertis, oblongis, distincte pedunculatis; nervo medio apicem versus evanescente; nervis secundariis anastomosantibus.

I have given as complete a diagnosis as possible from the two specimens figured in the present paper, but as it is have been obliged to take some of the characters from McClelland's original specimens of *Glossopteris acaulis*, which are in our Museum, and of which it is my intention to give better figures in my monograph.

The two specimens figured from Mr. Wood-Mason's collection certainly belong to the same species.

They differ from *Glossopteris* by their net-venation and by the midrib vanishing towards the apex. The specimens here figured are basal portions of leaves and well show the stalk. Their relative position to each other on the stone is such as to lead one to suppose they were inserted on a common stalk.

With this I will rest satisfied at present. *Sagenopteris* is a Rhætic and Liassic form, and I do not think anybody can consider our form as Palæozoic.

I think that amongst the Raniganj fossils in the Geological Museum will be perhaps some more forms of this genus, but as these are still undescribed, I will not mention them here.

Of other ferns, which are also from the Raniganj group, and which I have partially described, I may on account of the connection also mention

Actinopteris Bengalensis, Feistm.

1876. Feistmantel Rec. Geol. S. Ind. IX. 3. p. 76.

In my note (l. c.) I have given a diagnosis of this fern and have here nothing to add. I will describe the species fully in a future paper and give a figure of it.

I now give a general list of the ferns as I did in the case of the *Equisetaceae.*

General view of the Filices *in the Raniganj field.*

Names of the species from the Raniganj field.	Where in other portions of the Damúdas and analogies in the Upper Gondwanas.	Analogies in Europe.		Analogies in Australia.
		Trias.	Jura.	
Order *Sphenopterides.*				
Sphenopteris polymorpha, Feistm.	In the Barákar group, Talchir (Cuttack) Orissa.	....	*Sphenopteris athyrioides,* Bgt. sp.	*Sphenopteris alata,* Schimp., the upper portion only.
Order *Pecopterides.*				
Group of *Alethopteris Whitbyensis,* (Schimp. 1869 Fstm. 1876)				
Alethopteris Lindleyana, Royle sp.	Analogous to *Alethopteris indica,* O. M., from the Rajmahal Hills.	....	*Alethopteris Whitbyensis,* Göpp. in Lias and Oolites. *Asplenites (Cladophlebis) Rosserti* Schenk, from the Rhætic.	*Pecopteris (Alethopteris) australis,* McCoy, from Tasmania (mezozoic).
Alethopteris comp. Whitbyensis, Gopp.	*Alethopteris Whitbyensis* in Kach. *Al. indica,* O. M., in Rajmahal Hills.	....		
Type *Phegopteris,* Mett.				
Alethopteris phegopteroides, Fstm.	....	*Pecopteris Stuttgardensis,* Bgt. (Keuper).	....	....
Order *Tæniopterides.*				
Macrotæniopteris danæoides, Royle sp.	In the Barakar group near Burgo, (Rajmahal Hills.) Some analogy with *Macrot. musæfolia,* O. M., Rajmahal Hills.	....	Some liassic forms.	....

Names of the species from the Raniganj field.	Where in other portions of the Damúdas and analogies in the upper Gondwanas.	Analogies in Europe.		Analogies in Australia.
		Trias.	Jura.	
Macrotæniopteris sp.......	....	....	....	....
Type *Vittaria*, Swartz.	....	....	....	....
Genus *Palaeovittaria* nov., Fstm.				
Palæovittaria Kurzi, Fstm.				
Order *Dictyopterides*.				
Genus *Belemnopteris* nov., Fstm.				
Belemnopteris Wood-Masoniana, Fstm.	....	....	....	....
Genus *Gangamopteris*, McCoy, ...	....	....	....	....
Gangamopteris Whittiana, Fstm.	Genus in the Barakars and Talchirs.	....	....	Genus in Australia (Victoria).
Genus *Glossopteris*.				
Glossopteris angustifolia, Bgt.	....	....	....	....
Glossopteris communis, Fstm.	Throughout the Damuda Series.	....	....	New South Wales? upper coal-strata.
Sagenopteris polyphylla, Fstm.	....	....	Genus Rhætic and Liassic.	....
Actinopteris Bengalensis, Fstm.	....	....	Genus Rhætic.	....

Conclusions.

1. Mr. Wood-Mason's collection has yielded 14 species, two belonging to the Equisetaceæ, and 12 being ferns.

2. Amongst these fourteen are two new genera (besides a new type of *Alethopteris)* and seven new species. The collection, therefore, increases considerably our previous knowledge of Raniganj plants.

3. The character of the whole flora is mezozoic. The prevalence of ferns with net-venation (not being *Glossopteris)*, and the occurrence of *Taeniopteris* especially shows this.

4. But also *Glossopteris* has shown some differences as compared with those in Australia: I refer to the marginated margin in *Glossopteris*

angustifolia, indicating perhaps a *Pteris*-fructification, while some Kamthi specimens show a *Polypodium*-fructification, and some Australian ones show a fructification along the veins.

5. Amongst the Equisetaceae *Schizoneura* is decisive, which is so frequent in the collection of the Geological Survey.

6. Amongst the ferns the *Alethopteris phegopteroides* is very close to the living *Phegopteris; Belemnopteris* is very close to some living forms; *Gangamopteris Whittiana* is very close to the living *Antrophyum;* and *Palaeovittaria* is very remarkable; of importance besides these is *Macrotaeniopteris dannaeoides* and *Alethopteris* comp. *Whitbyensis*, Göpp.

Alethopteris phegopteroides reminds one also of a Triassic type, the *Pecopt. Stuttgardensis*, Bgt.

7. Mr. Wood-Mason's specimens afford strong corroboration of my views as to the mezozoic age of the Damudas in general.

8. With the lower portion of the Damudas, namely with the Barákars, the upper has *Sphenophyllum trizygia*, *Vertebraria indica*, *Sphenopt polymorpha*, *Macrotaeniopteris danaeoides*, *Glossopteris*, *communis*, and the genus *Gangamopteris,* in common; so that the close palæontological connection of the two is again seen.

9. The Kamthi group has with the Raniganj the same *Phyllotheca indica*, *Vertebraria indica,* and the same *Glossopteris communis* in common.

10. With the Australian lower coal-strata no comparison at all is possible as not one single marine animal has been met with in our Raniganj group or indeed in any part of the Damuda Series.

11. A comparison, if any, is only possible with the upper coal-beds of Australia, which alone are mezozoic and contain several fossils identical with those of our Damuda Series.

12. A complete register of the fossils from the Damúdas, including Mr. Wood-Mason's new forms, has been given by me in Records G. S. India, 1876, IX, No. 4.

EXPLANATION OF THE PLATES.

Plate XV.

Figs. 1—2. *Sphenophyllum Trizygia*, Ung. Two branchlets showing well the characteristic disposition of the leaflets in the articulation. Fig. 2*a*. One leaflet enlarged to show the mode of origin and the distribution of the veins.

Figs. 3—4. *Vertebraria Indica*, Royle. Fig. 3. Good specimen, with a branch exhibiting the same characters as the main stem. This specimen is particularly remarkable, as showing distinctly enough ribs on the surface, which in several places (*a a a*) form "articulations." Fig. 4. A portion of a rootlet of the same species.

Plate XVI.

Figs. 1—3. *Schizoneura Gondwanensis*, Feistm., branchlets and leaflets of this important species.

Fig. 4. *Vertebraria indica*, Royle, a stem exhibiting regular articulation, and consequently the equisetaceous nature of this fossil.

Figs. 5—7. *Sphenopteris polymorpha*, n. sp. Fig. 5, top portion of the frond. Figs. 6 and 7, leaflets from lower portions. The rhachis broadly winged.

Plate XVII.

Figs. 1—3. *Sphenopteris polymorpha*, n. sp., illustrating pinnæ from different portions of the frond. Fig. 1. Top portion. Fig. 1*a*. A leaflet enlarged. Figs. 2 & 3. Pinna and leaflet from the lower portion of the frond. Fig. 3*a*. One pinnula enlarged. Rhachis broadly winged.

Plate XVIII.

Figs. 1. 2. *Alethopteris phegopteroides*, n. sp. A very interesting type in the group of *Pecopterides*, approaching most strikingly the living *Phegopteris*. Fig. 1. Shows a portion of the frond and the disposition of the pinnæ and the pretty thick rhachides. Fig. 2. Two entire pinnæ with their apices. Fig. 1*a*. Illustrates the disposition of the veins in the pinnulæ. Fig. 2*a*. The top portion of the pinna.

Plate XIX.

Fig. 1. 2. *Macrotaeniopteris (Taeniopteris) danaeoides*, Royl sp. (McClell.). Two out of many other specimens. Fig. 1*a*. Shows the distribution and the mode of furcation of the veins.

Figs. 3. 4. *Palaeovittaria Kurzi*, gen. et sp. nov. Fig. 3*a*. Shows the basal portion, with the midrib and secondary veins issuing from it. Fig. 4*a*. The relations of the secondary veins in the top portion.

Plate XX.

Figs. 1—2. *Belemnopteris Wood-Masoniana*, gen. et sp. nov. (N. B.—The two lobe-veins are a little exaggerated.) Fig. 2. Represents what is believed to be the top portion of the leaf of the same species.

Figs. 3—4. *Gangamopteris Whittiana*, n. sp. Two specimens with very large areoles of that intermediate form between *Glossopteris* and *Cyclopteris*, which has lately proved so frequent in our Barakur group. These specimens exhibit very well the distribution of the vein-areoles in two directions towards the margin without any midrib.

Figs. 5—6. *Sagenopteris polyphylla*, n. sp. These two specimens belong, I believe, to that form which McClelland first mentioned as *Glossopteris acaulis*, which, however, I consider to be a *Sagenopteris.*

Plate XXI.

Fig. 1. *Macrotæniopteris danaeoides*, Royle sp. a portion from the middle part of the leaf enlarged to show the development of the secondary veins from the midrib.

Figs. 2—4. *Glossopteris angustifolia*, Bgt. Fig. 2. A nearly complete leaf with base and apex. Figs. 3 and 4 top portions of the leaf—all exhibiting the marginated margin which probably indicates the fructification—which in this case would be a "*fructificatio-Pteridis.*" Fig. 2*a*. A portion, enlarged to show the veins and the marginal smooth longitudinal portion of the leaf.

Fig. 5. *Glossopteris communis*, n. sp. A portion of a *Glossopteris*, which is very frequent throughout the Damuda Series.

Fig. 6. *Alethopteris Whitbyensis* (?), Göpp. Two pinnulæ belonging most probably to this mezozoic species.

INDEX.

☞ Names of new genera and species have an asterisk (*) prefixed.